

**High Energy Astrophysics Research  
and Programmatic Support  
Contract No. NAS5-32490**

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**Technical Report**

**for**

**April 1, 1994 through June 30, 1994**

**NASA/Goddard Space Flight Center  
Contracts Office  
Mail Code 286  
Greenbelt, Maryland 20771**

**by**

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Building #26, Room 215  
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Greenbelt, Maryland 20771**





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GODDARD VISITING SCIENTISTS' PROGRAM / HIGH ENERGY ASTROPHYSICS PROGRAM

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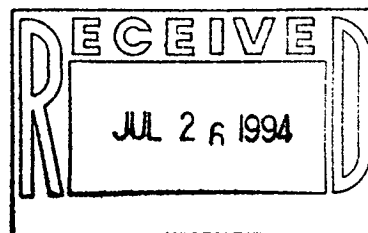
July 26, 1994

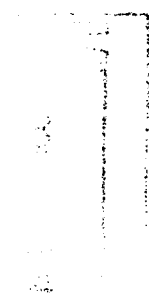
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Enclosed is a copy(ies) of the Technical Report for the USRA/Goddard Visiting Scientists Program under contract NAS5-32490 for the period of April 1, 1994 through June 30, 1994.

If you have any questions, please don't hesitate to contact us.

David V. Holdridge  
Project Manager





**July 26, 1994**  
**Contract No. NAS5-32490**  
**Technical Reports**  
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Subject: Enclosed is the Technical Report for the Period  
April 1, 1994 - June 30, 1994



**Brief Summary of Task Activities under Contract NAS5-32490 During the Period of  
April 1, 1994 through June 30, 1994**

**(Individual Project Reports are attached on the indicated pages)**

**Summary notation and actual reports are sequentially listed by Task Number**

<b><u>Page #</u></b>	<b><u>Task Number</u></b>	
<b>1</b>	<b><u>93-01-00</u></b>	<b>Angelini</b> assisted in the development of the XRONOS 4.02 and XIMAGE 2.5 and was responsible for the completion of the barycenter for ROSAT data correction task as well as the manipulation of two lightcurve FITS files. She also conducted an analysis of the ASCA/ROSAT data of the X-ray pulsar 4U1626-67, the ASCA data of the X-ray pulsar GX301-2, as well as the optical identification of the serendipitous sources in HH-1. Three proposals where she is co-investigator have been accepted.
<b>4</b>		<b>Drake</b> continued working on making a FITS database out of the Einstein MPC database and finalized the MPC FITS files formats after several iterations with the OGIP FITS Working Group. He also continued to monitor the anonymous ftp and Gopher services and the ADS access provided by the HEASARC to the scientific community. At the request of the HEASARC director, he has resumed the overall responsibility for ensuring that all e-mail to the HEASARC be answered as fully and rapidly as possible.
<b>7</b>		<b>George</b> continued the maintenance and development efforts of the OGIP Calibration Database and the development of the FTOOLS software. He spent more time this quarter performing personal research in the area of the ROSAT PSPC AO-1 observations of the Seyfert 1 galaxy Mrk 841. Dr. George has had four papers accepted for publication and three others that await acceptance.
<b>12</b>		<b>Whitlock</b> completed the salvage of all 250 lightcurves from the Ariel 5 ASM residing on the IBM, putting them into FITS and on-line for HEASARC access. She also completed the ingest of the Einstein Level 0 data and processing software as well as a "first run" through the Vela 5B all sky data, looking for significant deviations from the background for her ADP grant. Dr. Whitlock has had a paper submitted for publication and another accepted for publication.



<u>Page #</u>	<u>Task Number</u>	
14	<u>93-02-00</u>	<b>Corcoran</b> supervised the data ingest into the NDADS archive task and responded to 521 inquiries via email regarding the ROSAT public archive, FITS development for ROSAT, OGIP FITS and RGOF issues. He also contributed to designing, writing, testing and implementing routines to move data from the NDADS staging area to the legacy jukebox, and he supervised the development of the RDF software, as well.
16		<b>Snowden</b> completed his software for the analysis of ROSAT PSPC observations of extended sources and the diffuse X-ray background and is ready for public release. He provided technical reviews and support for the round of AO-5 ROSAT proposals and continued his research on the LMC data and the diffuse background maps from the ROSAT all-sky survey. He has had two ROSAT AO-5 proposals accepted and a lead author paper resubmitted for publication.
18		<b>Turner</b> worked on the analysis of new PANTER ground calibration data from the recent recalibration of the engineering model of the PSPC. She also worked on the analysis of the in-flight aluminum K line data and responded to an average of five email/telephone queries per day regarding ROSAT issues. Dr. Turner served as a technical advisor for the AO-5 proposal review.
21	<u>93-03-00</u>	<b>Day</b> continued to coordinate and participate in the advising of ASCA Pis on how their AO-1 observations should be carried out and helping ASCA Guest Observers who visit the ASCA Guest Observer Facility at GSFC. In addition, he completed writing, editing and compiling the new issue of the "ABC Guide to ASCA Data Reduction" (105 pgs) and the new set of appendices to the third ASCA NRA (100+ pgs). Dr. Day co-authored three papers accepted in refereed journals and submitted two ASCA AO-2 proposals as PI and four as Co-I.
22		<b>Ebisawa</b> created a program which carries out orbital modulation correction of binary pulsars as well as the ASCA GIS night earth database. He assisted in the ASCA data analysis for two Guest Observers and worked on the calibration of the GIS instrument which is onboard ASCA. In addition, he analyzed the ASCA data of Cen X-3 and Cyg X-1 and had a paper published, two others accepted for publication and a proposal accepted for ROSAT AO-5 in this quarter.



<u>Page #</u>	<u>Task Number</u>	
24	<u>93-03-00</u>	<b>Mukai</b> worked on several ASCA datasets, analyzing the light curve of YY Gem, the AO-1 data on V834 Cen and the PV data on AM Her. He also completed the creation of a software tool to handle one particular calibration issue: the SIS detectors are slowly degrading due to cumulative effects of radiation change.
25	<u>93-04-00</u>	<b>Lochner</b> continued contributing to the development of the Guest Observer Facility for the X-ray Timing Explorer as well as the development of XTE FTOOLS and its delivery for the XTE Science Operations Center. He also participated in issues surrounding the preparation of the upcoming NASA Research Announcement for XTE observing proposals. Dr. Lochner saw the completion of two research projects and the initiation of another this quarter.
27		<b>Rots</b> completed the "Build 3" and "Build 3.1" versions of XFF, providing considerably expanded capabilities for handling science data. He also developed a first version of an intelligent EDS configuration selection assistant and created more sets of data descriptors and template FITS files for various instruments and modes. In addition, he and B. Pence have finished the first stage of the analysis of the ROSAT data on NGC 1961.
31		<b>Schlegel</b> completed two key programmatic tasks during this quarter: preparing for the XTE NASA Research Announcement and revamping the guest observer proposal preparation tools. Three papers have been submitted for publication, and another is near completion. In addition, the ROSAT data on the galaxy NGC 6946 has been accepted and scheduled for publication.
34		<b>Smale</b> continued to manage the XTE Guest Observer Facility which involves manpower, hardware budgeting and heavy politicking, overseeing the efforts of other scientists and programmers, PR, etc. He also chaired the selection committee for the post of SOF Chief Duty Scientist and worked on the analysis of X1820-303 for ASCA. In other areas, Dr. Smale expanded his programming education by writing the first FTOOL in the C programming language.
37	<u>93-05-00</u>	<b>Giles</b> continued work as the Software Manager for the PCA experiment software development and deliveries to the XTE Science Operations Center. He also continued to support the Goddard team developing the PCA detectors for the XTE satellite. He continued to coordinate the work of five programmers, and as the Chairman for the search committee for an additional PCA scientist, he interviewed and selected a candidate to fill the position.



<u>Page #</u>	<u>Task Number</u>	
40	<u>93-05-00</u> (continued)	<b>Zhang</b> implemented his systematic scanning technique and found/replace many bad wires from detectors for XTE/PCA. He conducted two spacecraft system level tests with the PCA instruments as well as the end-to-end timing test. Dr. Zhang also checked the uniformity of 5 of the 6 XTE/PCA proportional counters, developed software tools and gave necessary scientific supervision and advise to the technicians involved. Two papers and a proposal for XTE/PCA observations were started in this quarter.
42	<u>93-06-00</u>	<b>Chen</b> worked on the Optical Counterparts, Long-Term Variabilities, Radio Jets and Accretion Sources in 1E 1740.7-2942 and GRS 1758-258 and also furthered his study on COMPTEL. Both areas of research were submitted as papers and accepted for publication. In addition, he contributed and is still in the process of completing four separate papers in the areas of X-ray nova light curves, radio emission from stellar winds, disk instability models of black hole X-ray novae and 1.8 MeV Emission of $^{26}\text{Al}$ .
43	<u>93-07-00</u>	<b>Christian</b> worked on the data analysis, writing and editing his paper on ALICE (A Large Isotopic Composition Experiment) as well as on the data analysis of the data from the 1992 flight of IMAX (Isotope Matter-Antimatter eXperiment). In addition, he was responsible for the onboard command and data handling system and the ground support equipment for ISOMAX. Dr. Christian worked on the ACE (Advanced Composition Explorer), Voyager Cosmic Ray System and the TIGER (Trans-Iron Galactic Element Recorder), as well.
46	<u>93-08-00</u>	<b>Schaefer</b> continued the task of BATSE data analysis, comparing the BATSE SD spectra with Ulysses and Ginga data. He also worked on BSAS programming. He tested a new robust version of CONF, searching for transient error in MATRIX and testing LSRCH. Dr. Schaefer also completed his study of the cross calibration of BATSE, COMPTEL, OSSE and EGRET and initiated a collaboration with D. Hoffleit regarding optical transients.
47	<u>93-09-00</u>	<b>Barthelmy</b> spent this quarter on four areas of activities: 1) the Gamma Ray Imaging, 2) the Gamma Ray To Optical Transient Experiment (GTOTE) and 3) several miscellaneous activities. The fourth and the most time consuming task was the BACODINE project, where there are currently 16 operations receiving GRB locations at 20 sites with 23 instruments. Dr. Barthelmy is a Co-I for two GRO Phase IV proposals and a PI for another.



<u>Page #</u>	<u>Task Number</u>	
49	<u>93-10-00</u>	<b>Palmer</b> conducted an analysis of Gamma-Ray Burst (GRB) data from the BATSE SD instrument on Compton Gamma-Ray Observatory (GRO) and searched for radio counterparts of GRBs. He also made preparations of the Transient Gamma-Ray Spectrometer (TGRS) for launch on the WIND spacecraft, scheduled for November 1994. In addition, he participated in the review of phase 4 GRO guest investigator proposals, where he evaluated 48 proposals and was either the primary or secondary reviewer of a dozen of these.
51		<b>Seifert</b> lead the Transient Gamma-Ray Spectrometer (TGRS) software development, and was responsible for all the software requirements/specifications and documentation. He also worked on designing and testing the algorithms used by the software. He took a lead part in the laboratory testing of the TGRS analog/digital flight electronics and software. In addition, he formulated and conducted all the instrument tests and calibrations during the integration and calibration phase of TGRS as well as for the design of the procedures used during the actual flight mission.
53	<u>93-11-00</u>	<b>Mitchell</b> is responsible for the development of the time-of-flight system and the experiment electronics, including a new low-power flight system for ISOMAX. He coordinated the evolutionary developments in the ISOMAX balloon instrument design. Other primary activities for Dr. Mitchell included the analysis of the 1992 IMAX flight, preparations for the WiZard 1994 balloon campaign, analysis of data from accelerator experiments and the development work on new flight and ground based experiments. In addition, he began work on three new research papers for publication.
56	<u>93-12-00</u>	<b>Dingus</b> transferred the drift chamber stack to a balloon gondola and assembled a vacuum pumping system for the balloon gondola. She also collaborated with numerous universities on MILAGRO, a ground based TeV Gamma-Ray detector. Dr. Dingus has a paper in progress, another submitted for publication and a ROSAT AO-5 proposal accepted.
57	<u>93-12-00</u>	<b>Sreekumar</b> assisted in carrying out the routine reduction and analysis of data from the EGRET instruments on the Compton Gamma Ray Observatory, and he worked on overseeing the manual editing of spark chamber events on screens, creating the summary database and the exposure history database for each viewing period. He also conducted additional analysis of the high energy Gamma Ray emissions from the North Galactic Pole region. A new version of the EGRET allsky DIFFUSE model was released.



<u>Page #</u>	<u>Task Number</u>	
59	<u>93-13-00</u>	<b>Miller</b> was involved in four projects this quarter. He considered stochastic gyroresonant ion acceleration by cascading Alfven wave turbulence and worked on the investigation of the nonlinear Landau damping of two parallel Alfven waves by a hybrid plasma simulation. Dr. Miller looked into the problem of stochastic acceleration in black hole magnetospheres and the accompanying radiation processes in addition to electron acceleration by fast mode waves.
60	<u>93-14-00</u>	<b>Soong</b> analyzed the ASCA data and worked on the Galactic binary X-ray emitters such as Her X-1, Vela X-1, 4U0614+091, etc. In addition, he carried out research which was a part of a GSFC DDF proposal. He was a part of the team that made and verified improvements to the image of the thin foil X-ray mirror with the newly established replication process.
61	<u>93-15-00</u>	<b>Yaqoob</b> analyzed ASCA data specifically on the four targets: PG1211+143, NGC 3227, MKN 3 and NGC 4151. Significant progress was made with regards to documentation on the analysis tools as well as updating and adding new routines to the suite of IDL routines especially development for ASCA analysis. Dr. Yaqoob authored four papers which were submitted for publication and five others which were accepted and published.
63	<u>93-16-00</u>	<b>Madejski</b> furthered the development of the X-ray Spectrometer (XRS) instrument. Due to the cancellation of AXAF-S, changes were necessary since the instrument was now to be flown on a Japanese mission ASTRO-E. Specifically, his efforts were to find ways to make the XRS lighter in weight, smaller in dimension and more efficient in power consumption. In addition, Dr. Madejski has either completed or considerably advanced a total of ten different papers/projects in this quarter as well as having an ASCA proposal accepted and two ROSAT proposals still pending.
66	<u>93-17-00</u>	<b>Gibbons</b> assisted Dr. R. Mushotzky (LHEA) in editing journal/review articles and preparing proposals. She also continued her research on the origin of the X-ray background, finishing error calculations for her model. Research on clusters of galaxies were also conducted this quarter.



<u>Page #</u>	<u>Task Number</u>	
67	<u>93-17-00</u> (continued)	<b>Loewenstein</b> was involved primarily in the ASCA PV phase observations of the elliptical galaxies NGC 1404, NGC 4374 AND NGC 4636. His ROSAT PSPC investigation of the elliptical galaxy NGC 4697 that includes spatial and spectral analysis of both diffuse emission and a population of point sources is near completion. Two papers have been submitted for publication.
68	<u>93-19-00</u>	<b>Hubeny</b> continued working on an analysis of the Hubble Space Telescope observations using his computer program TLUSTY for computing non-LTE line blanketed model stellar atmospheres. He also performed a preliminary analysis of the first post-servicing mission GHRS spectra of two hot stars, members of the R136 cluster of 30 Doradus in the Large Magellanic Cloud. In addition, four papers were published, and seven others were submitted for publication.
70	<u>93-20-00</u>	<b>Barrett</b> worked on testing the analysis program FADMAP. The SAS-2 and COS-B data were then processed and the results found acceptable. In addition, work was done developing a query program to access and display the observation file containing the list of archival GRO data. In addition, Dr. Barrett also worked on developing a list of publications about the Compton Gamma-Ray Observatory and related gamma-ray issues.
74		<b>Bonnell</b> performed time domain and spectroscopic analysis of gamma-ray bursts and support duties for the search for optical burst counterparts. In addition, he assisted in the preparation of materials for both the NASA HQ White Paper Presentation for the CGRO Project and the GRO display at the National Air and Space Museum. He also supported the GRO proposal review and prepared version 1.2 of the Compton GRO Science Support Center user's guide.
75		<b>Finger</b> researched both the aperiodic flux variability seen in the recent outburst of A0535+262 and a new technique he is developing for the estimation of pulsar accretion torque power spectra from pulse phases. He has made significant progress in the production of Archival data. The software for generating corrected pulsar low level folded on board data in FITS format was completed, tested and production initiated. Dr. Finger is involved in three cycle 4 Compton Observatory guest investigation proposals.
77		<b>Mattox</b> wrote approximately 130 email messages in support of EGRET guest investigator activities and made or received around 30 telephone calls. In addition, his paper on the likelihood analysis of EGRET data has been submitted. All three cycle 4 EGRET proposals have been accepted.



<b><u>Page #</u></b>	<b><u>Task Number</u></b>	
78	<b><u>93-20-00</u></b> (continued)	McGlynn provided technical leadership and coordination for the COSSC software group and generated the first Compton CD ROM which contained information from the EGRET Phase I all sky survey. He also continued the program. In addition, Dr. McGlynn continued to work on the analysis of EGRET observations of clusters of galaxies.
79		Shrader spent most of this quarter in preparation for the Cycle-4 CGRO Guest Investigator Proposal review. Guest Investigator inquiries were handled dealing with instrumentation technical details, program policies and procedures and the planned proposal evaluation process. In addition, he continued toward the development of a CGRO exhibit at the National Air and Space Museum. As the CGRO-SSC Group Leader, Dr. Shrader chaired a selection committee to review applications for the OSSE Instrument Specialist position.







University Space Research Association  
Goddard Visiting Scientist Program

Employee name: Lorella Angelini Task Number: 5030-01A-39

Period: 1 April 31 June 1994

### Software Development and maintenance

A new release of XRONOS 4.02 and XIMAGE 2.5 is underway (15 July). The software is distributed for DEC machines running ULTRIX and OSF, for SUNs, VMS, and also for Alpha/VMS.

*XIMAGE* : XIMAGE 2.5 includes a number of new features. COLOR and TIME images can be accumulated as well as intensity images from event files. The TIME weighted maps contain chi-square value obtained comparing the time distribution in each pixel against the time distribution of whole event file. The COLOR weighted images are obtained using the channel information stored in an event list FITS file. The channel (energy) for each photon, within each pixel, is summed and weighted by the number total number of photons within that pixel. COLOR-COLOR diagrams can be obtained from an event file for all the detected sources for a given image. Galactic coordinates can be now retrieved from cursor and/or overlay with a grid on the image. Smoothing can be obtained using a wavelet function. Documentation as been updated.

To allow the usage of the GUI (graphical user interface), developed by ESRIN (ESA) for XIMAGE, a number of commands to interface with the GUI has been changed. This work was done in collaboration with Paolo Giommi (ESRIN/ESA).

*XRONOS* : XRONOS 4.02 includes a number of new feature. New input file option are now available for the FITS file format. Those allow channels selection, extension table selection, columns selection. The folding program now accounts, in the search of periodicity, also for a constant period derivative. Gaps are not longer included in ASCII output file.

I was responsible to provide a number of new tasks timing related: a) barycenter correction for ROSAT data, b) Time at UTC for ROSAT data, c) manipulation of two lightcurve fits file. A programmer worked with me on those projects. The barycenter correction software has been completed as well as the ROSAT-Time to UTC. I have tested both using fast radio pulsar with well known radio periods.

I start working also on a new task which corrects the time of the data for the orbital period within a binary system.

The re-structure of the XRONOS programs will start after this realise. A programmer worked with me on those projects.

### FITS activities

I made a compilation of keywords and their definition regarding the specification within a FITS file for : a) energy or channel boundary b) exposure and related keywords. The final draft-memo of 'Standard String for DATAMODE and OBSMODE', by L. Angelini and I. George, is now available from the anonymous FTP account.

## EXOSAT related activities:

*EXOSAT archive raw data:* I worked on the creation of a new BROWSE database for EXOSAT data which combines the EXOLOG and EXOFOT databases. From this new database (EXOLOG) will be possible not only to retrieve information about the configuration of the instrument but also the file name and location of the raw data which has been archived on the optical juke-box.

The software to read the EXOSAT raw data has been installed on an ultrix machine, but not yet fully tested.

*FITS reformatting* The reformatting of the EXOSAT products is almost finished. All the LE1 and LE2 images as well as the GS and ME light curves are now available from the on-line service (FTP area and/or using browse under the xray account from the legacy node). 10 out of 3670 image files and 105 ME (19683 files) light curve could not be re-formatted in FITS because the original binary file were corrupted. The re-re-formatting of the LE1 and LE2 light curve has been completed but data are in the stage area (11941 files). The files need to be quality checked before made them available in the on-line service.

## Scientific Research:

During this period I worked on the following scientific project:

1) *Analysis of the ASCA/ROSAT data of the X-ray pulsar 4U1626-67.* The analysis of the ASCA SIS data shows evidence of a strong narrow line almost exactly at 1 keV. This line is about 1/3 the strength of the continuum and stands out in both SIS0 and SIS1 (eqw about 40 ev).

I found evidence for emission line at 1 keV in the Einstein SSS data, with lower significance compare to the SIS because of the lower exposure time. To assess the existence of this line I wrote a ROSAT PSPC proposal in which I included the SSS results. Unfortunately the PSPC ROSAT spectrum do not show evidence for such a line. The uncertainties due in the calibration gain of the ROSAT PSPC are such to move and distort the energy response. Fitting the SIS and the ROSAT PSPC data together was possible to adjust the ROSAT gain such that the PSPC spectra is consistent with the SIS showing a line at 1 keV.

The line energy and equivalent width in Einstein SSS and ASCA SIS data are remarkably similar. Fitting SIS pulse resolve spectra accumulated over the 7.66 spin period, I could determinate other characteristics of the line. The width, intensity and energy do not change with phase. The phase resolved spectra show also evidence for complex structure and wiggles around 1.2 and 1.4 keV which seem to come and go with phase. No evidence of a 6.4, 6.7, 6.9 keV line were found in the average spectrum of the SIS and GIS, with a upper limit of 20 eV.

The origin of this line is a puzzle. Two possible explanation as been investigated: the line can be interpreted as a Fe L-shell emission line, or as cyclotron line which implies a magnetic field of about  $10^{11}$  Gauss. Neither of these hypothesis seems in agreement with the observational results. I am now investigating the possibility that the 1 keV line can be produced by H-like K alpha Ne (1.05 kev). Ne 22 is the end result of one of the He burning sequences. If the line is consistent with Ne 22, this would imply that the companion star in X1626-676 is a Helium burning star rather than a Hydrogen-poor star.

2) *The optical identification of the serendipitous sources in HH-1.* The analysis of the optical data, obtained with the Palomar 60 inc telescope of the ROSAT X-ray detections in the star formation region in Orion, allow to identify all the X-ray detections. In particular we found that all the X-ray detection PMS star have H alpha emission line. This work is done in collaboration with Dr. S. Pravdo.

3) *Analysis of ASCA data of the X-ray pulsar GX301-2.* Together with Steve Pravdo and Charles Day we started the analysis of the GX301-2 data obtained with ASCA. In particular we concentrate on the spectral behaviour across the different pulse phase. Analysing the image we found a soft source close to the GX301-2 position. The soft spectra might have contaminated previous results interpreted as soft excess from GX301-2.

4) *ASCA and ROSAT Proposal.* I was co-investigator for three proposals two for the ASCA A2 ("Abundance anomalies in the dipper X1755- 338?", "Pulse-Phase Spectroscopy of GX1+4") and one for ROSAT A5 ("Study of pulsed X-ray emission and glitches of the Crab Pulsar). All of them have been accepted.

## **QUARTERLY TECHNICAL REPORT FROM DR. STEPHEN A. DRAKE**

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CODE 668/LHEA:HEASARC RESEARCH SCIENTIST

1994 April 1st - June 30th

### **WORK ACCOMPLISHED AND IN PROGRESS**

I was a Co-I on several proposals that were awarded observing time in this 3-month period: an ASCA AO-1 proposal (PI K.P. Singh [NRC]) to observe Speedy Mic, a ROSAT AO-5 proposal (PI Stephen White [University of Maryland]) to observe several Luminous Blue Variable (LBV) stars, and another ROSAT AO-5 proposal (PI Jeffrey Linsky [University of Colorado]) to do a rotational modulation study of the Magnetic Bp star HR 5624. For the latter proposal I also wrote a Very Large Array (VLA) observing proposal to obtain simultaneous radio coverage of this same star: the status of this radio proposal is not determined as of the time of this report.

I wrote a paper (with Jeff Linsky [U. Colorado] and Jay Bookbinder [SAO]) reporting the (null) results of a radio survey of two classes of early type, chemically peculiar stars, the Am (CP1) stars and the Ap/HgMn (CP3) stars. These are traditionally believed to be non-magnetic types of peculiar stars, but there have been recent claims to have detected magnetic fields in members of these classes. Our non-detection of any nonthermal radio emission from any of these stars tends to support the non-magnetic nature of these stars. This paper was submitted to the Astronomical Journal on the 17th of May, and we are awaiting the referee's report as of the present date.

I continued to monitor the anonymous ftp and Gopher services and the ADS access provided by the HEASARC to the scientific community. The amount of data that we are providing to users is presently of the order of 5 Gigabytes (Gb) per month, and appears to be growing linearly; by the beginning of 1996 it is conservatively extrapolated that we will be providing 10 Gb per month of data to the community.

I continued working with Jesse Allen (Hughes/STX) on our project to make a FITS database out of the Einstein MPC database. We finalized the MPC FITS files formats after several iterations with the OGIP FITS Working Group, and began a process of data verification that is now essentially complete. We have to date generated FITS files for about 25% of the mission. The remaining files should be generated in early July. A few remaining things that need to be done to complete this activity are discussed in the work planned for next quarter.

I received a large number of proposals submitted to a national observatory in my role as referee for observing proposals, and reviewed three of them that needed to be acted upon quickly. The remaining proposals will be reviewed in early July. I received from the NSF a set of proposals submitted to one of their research programs that I had previously agreed to referee, and plan to do this review in mid-July. I received a paper from the Astrophysical Journal which they had asked me to referee on June 7th, and relayed my report back to the editorial office on the 23rd of June.

I, together with KP Singh (NRC), Nicholas White (GSFC), and Ted Simon (U. Hawaii) completed a paper containing the results of our preliminary analysis of 2 ASCA observations of solar-type stars and submitted it to Astrophysical Journal Letters on May 23rd. We are waiting for the referee's report on this paper.

I served on an USRA Review Panel that evaluated applications and conducted interviews for the XTE SOF Senior Duty Scientist position that will shortly be filled. We submitted our recommendation to the USRA HEAD Program Director, and this activity is now complete.

I had 12.5 hours of VLA time scheduled in the second quarter of 1994 as a continuation of a program to search for radio emission from very low mass stars and brown dwarf candidates. I prepared the observing files myself on locally-installed NRAO software. None of these data have been reduced as yet.

I had 6 ROSAT observations scheduled to be made in the period from March 1 thru Jul 08 1994, and have received data tapes to date for 2 of these observations (both, as it happens, were non-detections). The first was an HRI observation of a magnetic white dwarf G240-072 for which we obtained an X-ray upper limit of  $10^{27}$  erg per second, while the second was an HRI observation of an Am star for which we obtained an X-ray upper limit of  $2.5 \times 10^{28}$  erg per second.

A paper on the radio source associated with the Luminous Blue Variable eta Carinae and its associated Homonculus Nebula of which I was a co-author appeared in the July 1 1994 Astrophysical Journal. A second paper that discusses the extraordinary radio outburst of this massive star is in preparation and will shortly be submitted to Nature.

At the request of the HEASARC director, Nicholas White, I have assumed overall responsibility for ensuring that all e-mail to the HEASARC be answered as fully and rapidly as possible. A new exploder request@legacy has been set up and all database queries and comments are now directed to this account. I verify at the end of every week that there are no unanswered messages to this exploder and maintain a mail folder of all user messages and their replies.

The creation of an SSS FITS database is still in progress; the commencement of the mass processing has been somewhat delayed due to some data integrity issues. Some arrays had values in them which looked like corrupted data, and so detailed byte by byte comparisons had to be made with the data in its original format on the NSSDC's IBM computer. This comparison showed that the data had not been corrupted by the transfer.

## **NON-LOCAL TRAVEL**

None.

## **WORK PLANNED FOR NEXT QUARTER**

I and Jesse Allen will complete the creation of a new independent and complete Einstein Monitor Proportional Counter (MPC) database in the form of FITS files. I will work with Pat Tyler and Song Yom (Hughes/STX) to create a BROWSE database that can be used to locate specific MPC observations in this database. I will work with the FTOOLS/XSELECT group to ensure that we will have appropriate software to operate on these FITS files.

I and Brendan Perry (Hughes/STX) will complete the creation of the new complete SSS FITS files database. I will work with Pat Tyler and Song Yom to create a BROWSE database that can be used to locate specific SSS observations in this database. I will work with the FTOOLS/XSELECT group to ensure that we will have appropriate software to operate on these FITS files.

I will continue overseeing the anonymous ftp account on HEASARC's LEGACY computer, as well as the HEASARC's ADS node, and the request@legacy user hotline.

I and Ian George (USRA) will start work on the creation of a new Einstein TGS database, building on the preliminary work already done by Tim Kallman (LHEA) and Saku Vrtilek (U. Maryland).

□

UNIVERSITIES SPACE RESEARCH ASSOCIATION  
GODDARD VISITING SCIENTIST PROGRAM

QUARTERLY TECHNICAL REPORT  
1994 Apr 01 – 1994 Jun 30

Employee Name: Ian M George

Activity: 5030-01A-39

Programatic Activities

Caldb Infrastructure & Access

My programatic responsibilities continue to be dominated by the maintenance & development of the *OGIP Calibration Database*, an on-line database designed to contain calibration files for all instruments for which the OGIP is responsible for supplying scientific data. Calibration datasets & documentation continue to be delivered by the various instrument teams and Guest Observer Facilities (GOFs) of current mission, as well as by HEASARC personnel responsible for the restoration/conversion of data from old mission.

A major new development over the last few months is that the Ron Zellar (STX) and myself have been working closely with the instrument team at ESA/ESTEC (Noordwijk, The Netherlands) for the LEGSPC detector for the Italian SAX satellite. These workers are keen to use our Calibration Database concepts & software for this instrument, but have suggested a number of minor changes/updates to fully accomodate their needs. These are slowly being ironed out — some being useful enhancements to the 'OGIP Caldb'; some resulting from misunderstandings.

The entire database continues to be accessible on-line via the `legacy.gsfc.nasa.gov` computer, and available world-wide via anonymous ftp, WWW etc. The number of files taken from the database per month continues to be somewhat erratic, most likely reflecting the erratic delivery of files from the hardware teams. Indeed, the rate of file retrieval shows a fairly dramatic decrease in the last quarter (Figure 1) — mainly since the various ASCA calibrations have not been revised in the last few months.

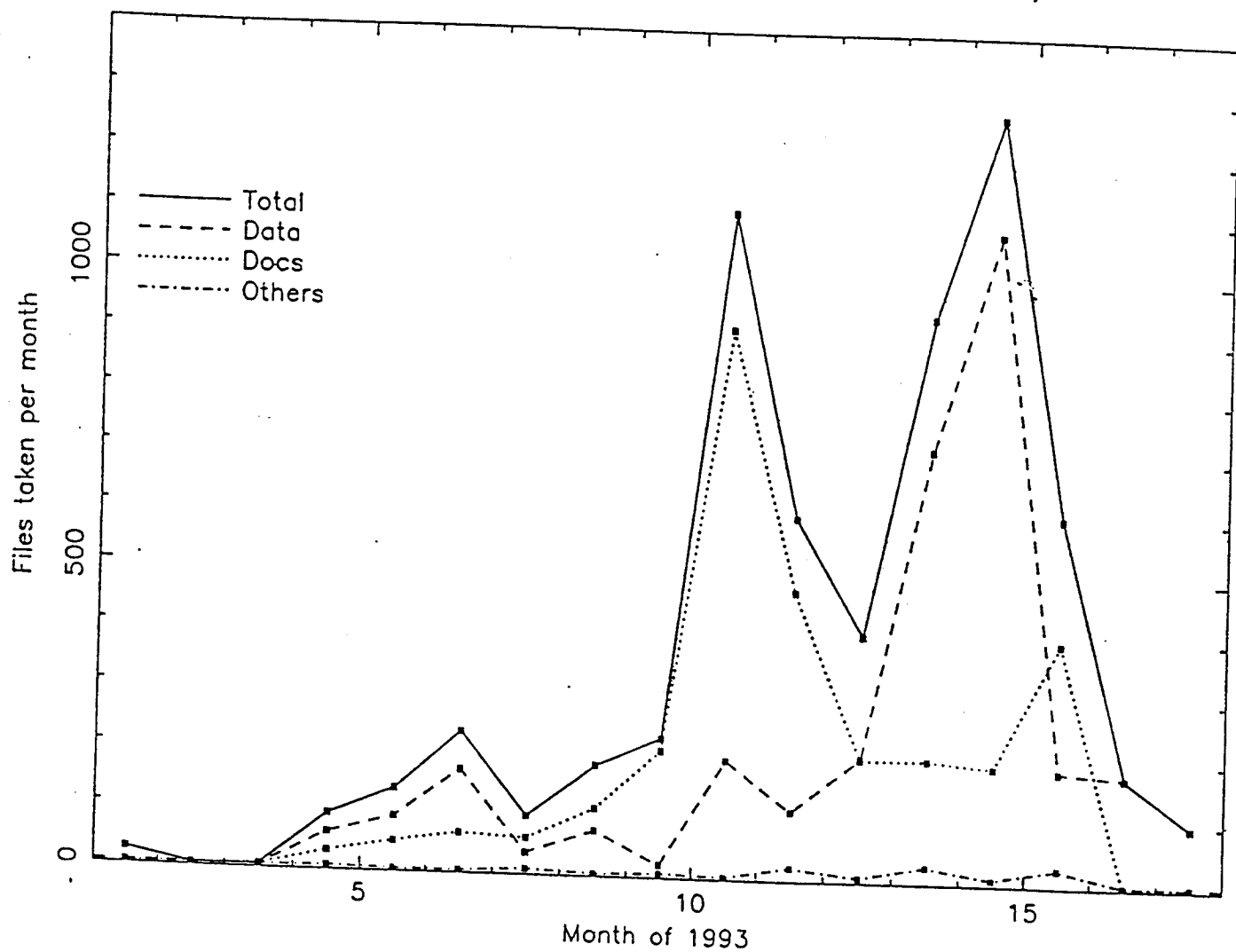
FTOOLS s/w

My work developing FTOOLS s/w has mainly involved the fixing of a few (relatively minor) bugs in and enhancements to the tasks for which I'm responsible. No new tasks were contributed by myself in the last few weeks.

Due to a requirement relating to the tasks required for maintenance of the OGIP Caldb, I have written a number of HTML pages relating to FTOOLS with the intention that they be incorporated into the HEASARC WWW weblet. Unfortunately the contributions required from others has not yet been forthcoming, hence this project is on hold.

FITS File Formats

CALDB FILES TAKEN (via anon ftp, excluding LHEA users)



GEORGE 13-JUL

I have continued to serve as the secretary of the OGIP FITS Working Group (OFWG). However there seems to have been little activity in the development of OGIP FITS file formats over the past quarter.

### Other

On 1994 June 10, I was pleased to receive an LHEA 'Peer Award' with the inscription

*"for his outstanding and dedicated support of the LHEA ROSAT Quest Observer Program. His ability to identify future requirements and develop methods to resolve them is a major contributor to the robustness of the program".*

(where I assume they mean 'Guest' instead of 'Quest'...)

### Personal Research Activities

Due to the fact that a large fraction of my hard-earned *ROSAT* Guest Observer data has recently entered the public domain, I felt it imperative to spend a larger fraction of my time on personal research this quarter (ie closer to the theoretical 50%). In this I feel I was largely successful, averaging  $\sim 33\%$ , compared to my normal  $\lesssim 5\%$ .

In collaboration with Nandra & Fabian (IoA, Cambridge, UK), Turner & Shrader (USRA), and Sun (Taiwan, ROC), a paper arising from *ROSAT* PSPC AO-1 observations of the Seyfert 1 galaxy Mrk 841 has now been submitted. We find the source to be variable on short timescales with clear changes in PSPC 'hardness ratio' (the ratio of fluxes in the high & low energy bands of the *ROSAT* PSPC) indicating the presence of at least two spectral components. We find that the *ROSAT* spectrum is best fit by models in which the intrinsic powerlaw spectrum is modified either by absorption by highly ionized material along the line-of-sight, or by an additional emission component contributing to the lowest energy PSPC channels. Remarkably, simultaneous spectral analysis of this PSPC dataset and the ultraviolet (UV) continuum data (obtained pseudo-contemporaneously with the *International Ultraviolet Explorer*, *IUE*), show that the best-fitting PSPC powerlaw extrapolates well into the UV. For this reason, the canonical accretion disc models of the UV/soft X-ray emission provide a poor explanation of the data. The paper then goes on to briefly explore the possible physical explanations of these data.

The above paper is very much a precursor to a much larger article reporting results from a *ROSAT* PSPC AO-3 monitoring campaign, a recent *ASCA* observation, along with a very large set of *IUE* and optical archival data on this source. This work is lead by myself and is a collaboration of those mentioned above, along with Balucinska-Church (Univ Birmingham, UK), Gondahalekar (RAL, UK), Malkan & Rush (UCLA), and Stone (Lick Observatory). Initial reduction of all these data is now almost complete, and it is hoped that a draft will be produced within a few weeks.

During the reduction of the above *ASCA* data from Mrk 841, Nandra, Turner and myself discovered a serendipitous source in the field of view. This was also found to be visible in the *ROSAT* pointings at the position of a distant (redshift  $z = 1.839$ ) highly-polarized quasar, PKS 1502+106. Such sources have received considerable attention recently following the detec-

tion of a number at  $\gamma$ -ray energies by *CGRO*. Thus a paper reporting the detection and spectrum of PKS 1502+106 has been submitted for publication in the 'ASCA Special Issue' of *Astrophys. J. (Letts)* scheduled for 1994 Nov.

### Papers Published/Accepted (in quarter ending 1994 Jun 30)

(NOTE: Due to the long turn-around time taken for papers submitted to refereed journals, most of the following scientific papers will have appeared in earlier quarterly reports as submitted/not accepted papers.)

#### *Refereed Journals:*

1. X-ray reprocessing by cold clouds in Active Galactic Nuclei  
Nandra, K & George, I.M.  
1994. *Mon. Not. R. astr. Soc.*, 267, 974.
2. The UK Deep and Medium Surveys with ROSAT: Log N – Log S  
Branduardi-Raymont, G., Mason, K.O., Warwick, R.S., Carrera, F.J., Mittaz, P.D., Puchnarewicz, E.M., Smith, P.J., Barber, C.R., Pounds, K.A., Stewart, G.C., McHardy, I.M., Jones, L.R., Merrifield, M.R., Fabian, A.C., McMahon, R. Ward, M.J., George, I.M., Jones, M.H., Lawrence, A. & Rowan-Robinson, M.  
1994. *Mon. Not. R. astr. Soc.*, in press.
3. Multi-wavelength Monitoring of the BL Lac Object PKS2155-304.  
IV. Multi-Wavelength Analysis  
Edelson, R., Krolik, J., Madejski, G. Maraschi, L., Pike, G., Urry, C.M., Brinkmann, W., Courvoisier, T.J.L., Ellithorpe, J., Horne, K., Aller, H.D., Aller, M.F., Ashley, M., Begelman, M., Blecha, A., Bouchet, P., Bratschi, P., Bregman, J.N., Carini, M., Celotti, A., Donahue, M., Fiegelson, E., Filippenko, A.V., Fink, H., George, I.M., Glass, I., Heidt, J., Hewitt, J., Hughes, P., Kollgaard, R., Kondo, Y., Koratkar, A., Leighly, K., Marscher, A., Matheson, T., Martin, P.G., Miller, H.R., Noble, J.C., O'Brian, P., Pian, E., Reichert, G., Saken, J.M., Shull, J.M., Sitko, M., Smith, P., Sun W.-H., Tagliaferri, G., Treves, A., Wagner, S., Wamsteker, W. & Warwick, R.S.  
1994. *Astrophys. J.*, in press.
4. X-ray Color Analysis of the Spectra of Active Galactic Nuclei  
Netzer, H., Turner, T.J. & George, I.M.  
1994. *Astrophys. J.*, in press.

*Non-Refereed Journals, Conference Proceedings etc:*  
None

#### *Other Articles:*

None

Papers Submitted, not yet accepted by Refereed Journals: (in quarter ending 1994 Jun 30)

(As above, the long turn-around time taken for papers submitted to refereed journals, will result in most of the following scientific papers appearing in more than one quarterly report.)

1. **A snapshot of the continuous emission of the active galactic nucleus in NGC3783 from gamma-ray to radio wavelengths**

Alloin, D., Santos-Lleo, M., Peterson, B.M., Wamsteker, W., Aitieri, B., Brinkmann, W., Clavel, J., Crenshaw, D.M., Evans, I.N., George, I.M., Glass, I.S., Johnson, W.N., Kriss, G.A., Malkan, M.A., Netzer, H., Polidan, R.S., Riechert, G.A., Rodriguez-Pascual, P.M., Romanishin, W., Starr, C.H., Stripe, G.M., Taylor, M., Turner, T.J., Vega, H., Winge, C. & Wood, D.O.S.

1994. *Astron. Astrophys.*, submitted.

2. **Soft X-ray and Ultraviolet Observations of Mrk 841: Implications for the Blue Bump**

Nandra, K., Turner, T.J., George, I.M., Fabian, A.C., Shrader, C. & Sun, W.-H.

1994. *Mon. Not. R. astr. Soc.*, submitted.

3. **The X-ray Spectrum of the Highly-Polarized Quasar PKS 1502+106**

George, I.M., Nandra, K., Turner, T.J. and Celotti, A.

1994. *Astrophys. J. Letts*, submitted.

### Non-Local Travel

None

### Work Planned for the period 1994 Jul 01 – 1994 Sep 30

Projected activities for the next quarter include:

- continued development of OGIP calibration infrastructure & access software — especially in collaboration with the LEGSPC team
- continued review & development of FITS file formats via the OFWG
- scientific analysis of recently obtained *ROSAT*, *ASCA* and *IUE* datasets

Progress Report 1 April - 30 June 1994

Task # 5030 - 01A-39

Laura A. Whitlock, Ph. D.



### Programmatic

Completed the salvage of all 250 lightcurves from the Ariel 5 ASM residing on the IBM, put them into FITS and on-line for HEASARC access. Only completion of the documentation remains for this mission.

With Dr. Eric Gotthelf (USRA) and Dr. Penny Haskins (Rad. Tech., Inc.), identified problems with the Vela 5B data (see the Science section) which must be cleared up before the raw data can be put into FITS and an FTOOL developed to allow community access. Once the problems are cleared up, however, this work will begin for both the time-ordered and position-ordered data bases.

With Jesse Allen (STX), used the DSDISK data base created long ago by Dr. Frank Marshall (NASA-GSFC) and the software created by Dr. Keith Jahoda (NASA-GSFC) to make the 16 most useful all-sky maps using the data from the HEAO 1 A-2 experiment. These have been put into FITS and will go on-line in July. Work will then begin on putting other data products, as well as the raw data, from this experiment into FITS and on-line on Legacy.

With Brendan Perry (STX), developed a plan to get the HEAO 1 A-1 pointed data off tape in a non-standard format and into FITS. Work is proceeding slowly since we have no byte map to tell us the format of the raw data, and we want to extract as much information as we can from each record. Nevertheless, progress is finally beginning to be made. There are some 325 pointings for which we have the data files.

Completed the ingest of the Einstein Level 0 data and processing software which we agreed to take due to the demise of the Einstein Data Center at the Smithsonian Astrophysical Observatory. The software was installed remotely by Dr. Dave Plummer of SAO and is now operational. The data have been put onto rewritable optical platters in the jukebox and onto DAT for safe keeping. July will be the time to 'learn the system' so as to be able to provide user support, when needed.

Continued to provide support to Dr. Ron Remillard of MIT to reformat the HEAO A-3 data. He is changing the data formats from the old Data General to UNIX. In doing so, he has found many old 800 bpi tapes which he cannot read on his machine. He sends these to me, I recover the data from them and mail him back something he can read and convert. This effort is now 3/4 done and should be finished by the end of July.

Continued to provide support to Dr. Richard Shubert (U. Cal-Fullerton) in his research on the cosmic background analysis of the Vela 5B data. He is in the 'determine what the results mean' phase of his work and has needed careful answers regarding the processing of the data he has analyzed.

## Science

The science effort for my current ADP grant went into high gear. We completed a 'first run' through the Vela 5B all-sky data looking for significant deviations from the background. We found significantly more points passed the criteria we had set than we expected. In investigating these data, we discovered that there was corrupted data throughout the data base. This brought the pursuit of science to an abrupt halt while I tried to track down the source of the error and see if the corrupted data could be restored. It became clear that the corruption occurred at Los Alamos when the data were processed off of the old Cyber 725 computer and reformatted to be readable on the VAX. Unfortunately, Los Alamos no longer has a copy of the Cyber version of the data base. So we are left only with multiple versions of the corrupted data. Faced with this, we began the tedious process of identifying and editing out all of the bad data points from both the time-ordered data base and the position-ordered data base. Once done, a 'clean' copy of the data sets will be delivered to NSSDC to replace their copy of the data, and used to regenerate the on-line data products at the HEASARC. Also, science on the data bases can then resume.

Thanks to the lightcurve of Circinus X-1 I put on the cover of the last issue of *Legacy*, I have struck up a collaboration with Dr. Niel Brandt at Cambridge University to analyze these data. Serious work will begin in July. We are both very interested in applying recent theories for this unique source to the Vela 5B data.

## Papers

- "Observations of the Small Magellanic Cloud by the Vela 5B X-Ray Monitor" by L. A. Whitlock and J. C. Lochner was formally accepted by *Astrophysical Journal* in June.
- Submitted abstract to the COSPAR meeting this July. It was accepted, and the complete paper will be published in *Advances in Space Research* later this year. A presentation of it will also be made at the COSPAR meeting.

## Other

Went to Career Day at Greenbelt Middle School on 11 April to discuss what it is like to be an astrophysicist/astronomer. This was arranged by the GSFC Educational Programs Office.

1994 2nd Quarter Report  
M. F. Corcoran (5030-02A-39)

1.

To: Crystal Wheatley  
From: Dr. M. F. Corcoran  
Activity: 5030-02A-39  
Subj: 2nd Quarter Technical report, 1 Apr 1994 - 30 Jun 1994  
Date: 15 Jul 1994

#### ACTIVITIES ACCOMPLISHED

##### 1) ROSAT public archive

- a) Supervision of data ingest into the NDADS archive is continuing
- b) Public ROSAT data sets have been moved to the HEASARC jukebox attached to the legacy machine. Routines to move data from NDADS staging area to legacy jukebox were designed, written, tested and implemented. In the 2nd quarter this included all data currently released to NDADS.
- c) The 2nd volume of the ROSAT image CDROMs were distributed at the June AAS meeting.
- d) the ROSAT archive data lists have been extensively revised and verified and implemented on the anonymous ftp area on legacy.
- e) Number of e-mail communications during the 1st quarter: 127

##### 2) Rationalized FITS development for ROSAT

- a) supervision of the development of the RDF software continued through the 2nd quarter. Bug fixes and enhancements continue.
- b) Number of e-mail communications during the 1st quarter concerning rationalized FITS development: 218

##### 3) OGIP FITS working group

- a) The OFWG has continued roughly bi-weekly meetings to discuss FITS issues in the OGIP.
- b) number of e-mail communications regarding FITS issues: 96

##### 4) RGOF duties

- a) The RGOF continued it's series of bi-weekly meetings
- b) I revised/updated documents in the ROSAT anonymous FTP account regarding the ROSAT data archive
- c) I published articles in *Legacy* and the *ROSAT Newsletter* describing the impact of REV1 and REV2 processing of ROSAT data on the archive.
- e) I provided technical support at the ROSAT AO5 review held in Jun.
- d) number of e-mail communications regarding RGOF issues: 80

#### TRAVEL

- 1) Attended IAU colloquium 163 in Elba Italy and presented a paper describing results of the ROSAT observation of V444 Cyg.

#### PAPERS SUBMITTED

1994 2nd Quarter Report  
M. F. Corcoran (5030-02A-39)

2.

"ASCA Solid State Imaging Spectrometer Observations of O Stars", M. F. Corcoran, W. L. Waldron, J. J. MacFarlane, W. Chen, A. M. T. Pollock, K. Torii, S. Kitamoto, N. Miura, W. Egoshi, and Y. Ohno, ApJL, submitted.

TALKS

- 1) STScI, on the ROSAT observations of the Carina Nebula
- 2) At UMd, on X-ray emission from normal stars.

PROPOSALS SUBMITTED/AWARDED

- 1) 3 ASCA proposals (Corcoran PI) were accepted for observation during the AO2 period.
- 2) 3 ROSAT HRI proposals were submitted (Corcoran PI) for observation during AO5; 2 proposals were accepted for time (though one target was placed in the "C" category).

PLANNED 3rd QUARTER ACTIVITIES

- 1) Continue supervision of ROSAT Public Archive including ingest of WG data.
- 2) Finish development of rationalized FITS calibration data files.
- 3) Continue guest observer support activities
- 4) Publish results of analysis of ROSAT observations of Carina Nebula, V444 Cyg and BBXRT data of Zeta Ori.
- 5) Write draft of paper summarizing work on Sco OB1
- 6) Begin analysis of Cyg OB2 ROSAT PSPC observation.

Dr. Steven L. Snowden  
USRA Quarterly Technical Report  
Task Number: 5030-02A-39  
1 April – 30 June 1994

23 June 1994

Code 666, Laboratory for High Energy Astrophysics  
*ROSAT* Guest Observer Facility

### Programmatic Work

The software which I discussed in the previous quarterly report for the analysis of *ROSAT* PSPC observations of extended sources and the diffuse X-ray background is now ready for public release. Extensive beta-site testing revealed few errors in the code, which were subsequently easily corrected. The documentation accompanying the software has proved to be useful (and very appreciated) as well. Feedback from the beta test sites allowed me to improve the documentation as well. The software which exists as stand-alone FORTRAN code is being converted for use in the HEASARC Ftool package. I am working on extensions to the package to allow the merging of multiple pointings. I have written the software (and used it for the LMC image discussed below) and am now converting it to use the Fitsio package for I/O and am improving the documentation.

As should be expected, I was heavily involved in the most recent round (AO-5) of *ROSAT* proposals. I provided technical reviews and support for one of the panels and participated in the International Users' Committee (IUC) meeting in Germany. While in Germany, I had discussions with MPE personnel about the calibration of the PSPC, *ROSAT* Users' Handbook, and Data Products Guide. Previous to the trip to Germany, I had extensively edited the *ROSAT* Users' Handbook for MPE's consideration. The discussion on the calibration status of the PSPC brought up some new systematic errors which I believe that we can address. I am working here at GSFC with Jane Turner on the spectral calibration of the PSPC.

The reduction of *ROSAT* trend data (diagnostic information for both the PSPC and HRI in more useful format) has now gone into production mode. This has been a joint project between Gail Reichert and myself. The data will be useful (for myself as well as others) in order to study various effects in the operation and calibration of the instruments.

### Scientific Work

This quarter has seen the start, and in some instances the more energetic continuation, of a number of projects. My lead-author paper "*ROSAT* Observations of the Eridanus Soft X-ray Enhancement" has been resubmitted to *The Astrophysical Journal*. Since the requested revisions were relatively minor, acceptance should not be a problem. I presented a poster at the AAS meeting in Minneapolis entitled "*ROSAT* PSPC Mosaic Images of the LMC, SMC, and Ophiuchus Dark Clouds" which demonstrated the utility of the software package that I have prepared for the *ROSAT* Guest Observer Facility. I am presently preparing a paper on the LMC data for submission to the *The Astrophysical Journal, Letters*. The poster was popular and I was asked to prepare a press release (which I did). I have subsequently been in contact with Astronomy magazine.

I visited the Space Physics group at the University of Wisconsin before attending the AAS meeting in Minneapolis in order to continue work on my lead-author paper presenting the diffuse background maps from the *ROSAT* all-sky survey. We had run into some compli-

cations in comparing our data with previous surveys which needed to be addressed. While in Wisconsin, I advised people about the use of my data-reduction software and presented a seminar on "The *ROSAT* Sky" (a seminar that I had previously presented at the Laboratory for High Energy Astrophysics).

For the summer, I will have a University of Maryland graduate student working with me on the analysis of *ROSAT* pointed-observation data. I expect the time spent to be beneficial for both of us and I hope that he will return for his thesis research when he has finished his preliminary requirements. Although the details are not finalized, I will be working with a high school science teacher GSFC summer intern, an experience which I am expecting to enjoy.

The *ROSAT* AO-5 proposal for a mosaic of HRI pointings of the SMC which I submitted was fully accepted for observation, although at only the C level of priority (not guaranteed to be scheduled). A similar proposal for the LMC in which I participated was also accepted with a mix of priorities (both guaranteed and C level). Both of these projects are very extensive and together received more than 10% of the total US observing time allotted for AO-5.

#### Plans for the Next Quarter

For the most part, the projects which I will be working on next quarter are continuations from this quarter and are discussed above. I have no work-related trips scheduled thus far.

Quarterly Report for April 1- June 30th 1994

T.Jane Turner

### **Project Support**

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I am currently working with Dr.Snowden on analysis of new PANTER ground calibration data from the recent recalibration of the engineering model of the PSPC. The new data were required to investigate the energy response of the PSPC when operated at different high voltage settings than originally planned. Modifications are now required to generate appropriate photon redistribution matrices which describe the energy response of the PSPC.

We have finally received the in-flight aluminium K line data. Analysis of these data indicate a severe gradient in gain across the detector face, this was not expected, and we must now alter the spatial gain calibration applied to the data, to account for this effect.

I supported the AO-5 proposal review as technical advisor, June 6-8 1994 at Tysons Corner.

Have been working ( as usual) with visiting Guest Observers and at the moment handle typically 5 email/phone queries per day on ROSAT issues. Have had positive feedback from visitors. Most of the time is spent answering email and phone queries on data analysis issues and software problems.

Was awarded the 1994 Peer Award for work in this area.

## Scientific Interests

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I had a successful PI proposal this quarter:

“An ASCA Investigation of the high equivalent width iron line in Mkn290” (\$8951 awarded)

Analysis of ASCA observations of NRAO140.

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PI Turner: This analysis is with Dr. Kitamoto and Mr. Suzuki of Osaka University, Japan, and Drs George & Madejski of GSFC.

NRAO140, a flat radio spectrum quasar at a redshift of  $z = 1.258$ , is one of the most luminous known X-ray quasars with  $L_{2-10 \text{ keV}} \sim 10^{47} \text{ ergs/s}$ . The extremely high luminosity may be related to a large central black hole mass, or may be due to beaming of the X-ray radiation. NRAO140 is a bright, core dominated radio source exhibiting superluminal motion with an apparent separation velocity of the radio components moving away from the core of  $4.8h^{-1} c$ , and thus its radio emission is quite likely to be beamed. Similarly, the synchrotron self-Compton limit requires some degree of anisotropy. Even though there is no direct evidence that the X-ray emission in this source is beamed, the correlation between the factor of 2 increase in both radio and X-ray fluxes strengthens the beaming hypothesis for the X-ray radiation. Initial analysis of the ASCA data places a 90% confidence upper limit on iron K emission at 37 eV, this constrains the solid angle subtended by reprocessing material to be  $< \pi/2$ , unless the continuum is beamed and swamps any spectral features due to reprocessing.

Multiwaveband observations of Mkn841

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PI is Dr. Ian George, collaborators are A.C.Fabian and K. Nandra at Institute of Astronomy, Cambridge, U.K., and Matt Malkan at University of California, LA.

We have obtained numerous ROSAT PSPC observations of Mkn841, with simultaneous IUE and optical observations, over the mission lifetime. We are currently analysing those data, and attempting to interpret them in the light of current popular models for active galaxies, with discussion of the applicability of accretion disk models to the data. WE recently made a huge amount of progress on this paper when Dr Malkan and Dr. Nandra visited GSFC (mid May).

**Work Planned for the next Quarter:**

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Fix PSPC spatial gain problem

Attempt to implement a fix to the energy response problem of the PSPC as a function of instrument gain.

Provide a cookbook for ROSAT analysis using the new xselect/ftools software.

Complete ASCA analysis of NRAO140

I will receive the data for my second ASCA observation, of Mkn290, I will analyze the data on receipt.

□

## **QUARTERLY REPORT: ARP-JUN 1994**

### **Programmatic Work**

- o Continued to field emailed queries sent by the US astronomical community to the asca help email "hot seat."
- o Finsihed writing, editing and compiling the new issue of the "ABC Guide to ASCA Data Reduction," a (currently) 105-page document describing how to reduce ASCA data.
- o Finsihed writing, editing and compiling the new set of appendices to the third ASCA NRA (100+ pages).
- o Continued to coordinate (and to participate in) the advising of US ASCA PIs on how their AO-1 observations should be carried out.
- o Continued to coordinate (and participate in) the help given ASCA Guest Observers who visit the ASCA Guest Observer Facility at GSFC. In particular, I assisted Drs R. E. White (U Alabama) & S. H. Pravdo (JPL).

### **Scientific Work**

- o Three co-authored papers accepted in refereed journals.
- o Began two new projects, both involving ASCA data: Abell 262, with Dr R. E. White (U of Alabama); and GX301-2, with Drs S. H. Pravdo (JPL) and L. Angelini (GSFC).
- o Submitted 2 ASCA AO-2 proposals as PI, 4 as Co-I.

□

## TECHNICAL REPORT FOR April 1 TO June 30, 1994

Ken Ebisawa (USRA Research Scientist )

task # 666-024

code 668, ASCA Guest Observer Facility

Office of Guest Investigator Program

Laboratory for High Energy Astrophysics, NASA/GSFC

### PROJECT WORK

- Having been working on the calibration of the GIS instrument, which is onboard ASCA, with the GIS team in the University of Tokyo and other members in the ASCA GOF.
- Visited ISAS, Sagamihara, Kanagawa, Japan, from June 8 to 15, and participated in the ASCA calibration workshop (travel report submitted).
- Made the ASCA GIS night earth database, which is to be released for ASCA Guest Observers to carry out GIS background subtraction.
- Helped making two observation plans for US ASCA Guest Observers.
- Assisted ASCA data analysis of two US Guest Observers visiting the GSFC Guest Observer Facility.
- Made a program which carry out orbital modulation correction of binary pulsars. This program was used by a US ASCA Guest Observer to analyze his data.
- Compiled the ASCA daily observation reports since the launch in the post-script format, and sorted the files with the date of the observation. These observation reports were made available for public with the World Wide Web.

### RESEARCH

- Having been analyzing the ASCA data of Cen X-3 and Cyg X-1. Submitted an application for the HEAD meeting in Oct. 1994, in California, for the presentation titled with "Iron Line Study of Cen X-3 with ASCA".
- *Papers Published:*
  - J. Greiner, G. Hasinger, S. Molendi and K. Ebisawa,  
"Near-simultaneous ROSAT and GINGA observations of the 1991 X-ray transient in Musca", *Astronomy and Astrophysics*, 1994, 285, 509
- *Papers Accepted:*
  - White, Arnaud, Day, Ebisawa, Gotthelf, Mukai, Soong, Yaqoob and Antunes,  
"An ASCA Observations of One Orbital Cycle of AR LAC", *Publication of the Astronomical Society of Japan*, April, 1994

- Fukazawa, Makishima, Ebisawa, Fabian, Gendreau, Ikebe, Iwasawa, Kii, Mushotzky, Ohashi, Otani, Ricker, Tanaka, Ueda and White  
“A Fluorescence-dominated X-ray Spectrum of the Spiral Galaxy NGC6552”, Publication of the Astronomical Society of Japan, April, 1994

- *Proposals Accepted:*

- Ebisawa, K. et al.  
“Study of Pulsed X-ray Emission and Glitches of the Crab Pulsar”  
for ROSAT AO-5

**Technical Report April 1–June 30 1994**  
**Koji Mukai (Task number: 93-03-00)**

**ASCA matters:** ASCA started AO-2 observation in mid-May; the next NRA was announced at about the same time but the release of the actual document was delayed.

ASCA GOF activities are settling down to a routine. I was assigned to help one guest observer reduce his ASCA data here at Goddard, and had the responsibility of planning GO observations in two two-week periods (one in early April, another in mid June).

I attended the Minneapolis AAS meeting to further publicize ASCA capabilities and results, as well as ASCA GOF services. This was a relatively small meeting but we did get sufficient number of questions to justify the trip (I was the only member of the ASCA GOF attending this meeting).

GSFC hosted a 2-day ASCA calibration workshop, June 27–28. Visitors from Japan (ISAS, Nagoya, Tokyo) and MIT and GOF members presented calibration status, problematic areas and plans for solving them. The high quality of ASCA data can reveal small ( $\sim 1\%$ ) imperfections in our understanding of the instrument; the workshop did produce some concrete plans, but this will no doubt be an on-going activity.

I have written a software tool to handle one particular calibration issue: the SIS detectors are slowly degrading due to cumulative effects of radiation damage. We will use PI, pulse invariant channels, so that a uniform energy scale could be used for all data. The new FTOOL, SISPI (I have just completed the first test version of this tool), together with the calibration file (to be supplied by SIS team) and new PI-based response matrices, will help combat the degradation of SIS.

**Science:** I have worked on several ASCA datasets. I have analyzed the light curve of YY Gem, a flare star, with Drs. White and Gotthelf. The results are being put together in a paper shortly to be submitted to ApJ Letters. I have begun the analysis of AO-1 data on V834 Cen, and continued my work on PV data on AM Her; the latter was summarized in a poster which was presented at the Minneapolis AAS conference and at the “Abano-Padova Conference on Cataclysmic Variables: Inter-Class Relations.”

At the Padova conference, I also presented a talk titled “Hibernation: Problems and Alternatives.” In this talk, I presented an observer’s point of view on the hibernation theory, based on optical and IR observations that I have been carrying out in collaboration with Dr. Naylor (Keele Univ). In addition to the conference proceedings, papers on the data we’ve accumulated over the years are in preparation.

**Next quarter:** The AO-3 deadline (just recently moved back to Aug 30) will be a major milestone — support for potential proposers and writing of own proposals are expected to take up much of my time during the month of August. In September, I hope to visit Leicester to work on ASCA PV data on cataclysmic variables with Drs. Osborne (Leicester) and Ishida (ISAS, will be visiting Leicester).

James Lochner  
LHEA Office of Guest Investigator Programs  
Code 668.0  
(Activity 5030-04A-39)

**2nd Quarter Report, 1994**

During this quarter I continued contributing to the development of the Guest Observer Facility (GOF) for the X-ray Timing Explorer (XTE). Much of my effort this past quarter was spent in continued development of XTE FTOOLS, and delivering those tools for the XTE Science Operations Center (SOC) Build 3, and the OGIP FTOOLS freeze date. I also worked to develop display materials for an XTE booth, which was set up at the Minneapolis AAS meeting in early June. Among other areas of the GOF development, I also participated in issues surrounding the preparation of the upcoming NASA Research Announcement for XTE observing proposals. With regard to research, this quarter saw the successful completion of two research projects, and the initiation of a third.

During this quarter I delivered four new FTOOLS as part of the SOC's software Build 3 at the end of April, and three of those FTOOLS as part of OGIP's FTOOLS freeze at the end of June. These FTOOLS provide users the ability to create simulated light curves, and to add known signals to input light curves. Such simulations can be used to determine the detectability of signals (e.g. sinusoidal variations) at various intensity values. These tools may be used not only for XTE, but also for other missions as well. In preparation for software delivery, I made minor enhancements, made the code conform to OGIP standards to insure portability to DEC, VMS, ULTRIX, and ALPHA platforms, and performed extensive testing. I also made the code available to scientists in the GOF and in the SOC for their use and comments.

These tools are being developed in preparation for release of the NASA Research Announcement for XTE proposals this fall. As such, during the coming quarter I will upgrade these tools to include non-sinusoidal variations, a typical XTE orbit viewing of a source, and QPO signals, among others. I will also finalized the tool for performing fourier analysis on data with multiple data gaps.

With the call for proposals due out this fall, XTE is continuing to make its presence known in the wider astronomical community. Part of this outreach includes providing a display booth at scientific meetings. During this past quarter, I put together materials for a booth set up at the American Astronomical Society meeting held in Minneapolis in early June. Working with Ms.

Karen Smale (STX), who has vast experience in designing display materials for ROSAT, HEASARC, and ASCA, we chose and designed materials appropriate for XTE. Some of these materials were graciously made available to us by the XTE project. Once the designs were complete, Ms. Smale interfaced with the Publications and Graphics Section at Goddard to produce the materials. The booth was well received at the Minneapolis meeting. These materials will be used at future scientific meetings, providing a backdrop for providing users with information regarding XTE capabilities, proposal submission, data analysis, and other services provided by the GOF.

During this quarter, I continued to participate at other various levels of the GOF development. I began overseeing more closely the delivery of calibration files and software from the HEXTE team, as well as their contribution for the technical appendix for the XTE NRA. I met with representatives of the PCA and HEXTE teams to discuss the content of the instrument "Feasibility" chapters for the technical appendix. Part of that effort included deciding what "worked examples" were desirable for inclusion in the appendix. This coming quarter will see the completion of these efforts for the technical appendix. I also participated in discussion of proposal policy issues. Near the end of the quarter, I prepared the XTE Project Data Management Plan for presentation to NASA's SOMOWG committee.

This quarter saw the completion of two science projects. My paper with Dr. Diane Roussel-Dupré (Los Alamos), "Recurrence Times and Periodicities in 4U1608-52 as Observed by Vela 5B", was resubmitted to ApJ, and was accepted for the Nov. 10, 1994 issue. Dr. Laura Whitlock (USRA) and I re-submitted to ApJ the paper entitled "Observations of the Small Magellanic Cloud by the Vela 5B X-Ray Monitor". This too was accepted for publication in Dec.

During this quarter, I initiated a collaborative work with Dr. Jean Swank (GSFC) and Mr. Warren Focke (Univ. Md) on continued development of shot models for Cyg X-1. Mr. Focke is examining Ginga data of Cyg X-1 for the character of the shot process. Together, we hope to be able to develop techniques which would distinguish among two currently debated representations of the shot model: whether all the shots have the same lifetime or whether there exists a distribution in the lifetimes of the shots. We wish to test our techniques on the Ginga data and simulated XTE data. We plan to present our preliminary results at the AAS High Energy Astrophysics meeting in early Nov.

Universities Space Research Association  
High Energy Astrophysics Program  
Technical Report  
2<sup>nd</sup> Quarter 1994

Arnold H. Rots  
Task number: 5030-04A-39

5 July 1994

## 1 XTE-SOC

### 1.1 XFF

The "Build 3" and "Build 3.1" versions of XFF were finished, providing considerably expanded capabilities for handling science data. Consequently, we have reached a state where FITS files can be used to certify the complete data path. This is of great importance, since it eliminates not only the need for intermediate certification efforts, but also the creation of any custom certification software, since existing tools can be used to carry out the certification of the FITS files. All HEXTE mode 1, 2, and 3 data configurations can now be handled, as well as PCA standard data modes. Instrument housekeeping awaits software fixes from the instrument teams.

XFF is clearly on its way to become a solid, mature system and the time spent on its conceptual design has paid off very well. Unfortunately, it has taken a larger share of my time than was anticipated. This was partly due to the fact that I had to cover for a programmer who was only partly productive,

for personal reasons, and partly because it falls on XFF to debug much of the instrument teams' code.

The XFF deliveries have been on schedule, with only a few minor (non-essential) exceptions.

XFF documentation was updated to the Build 3 level and now includes sections on Time and Unsigned Integers, as well.

## 1.2 FITS Formats

As in the past, more sets of data descriptors and template FITS files have been produced for various instruments and modes. The large task of designing FITS formats for all (present and future) envisioned XTE data configurations is nearing completion. A start has been made with the spacecraft data.

## 1.3 EDS Configuration Selection Assistant

I developed a first version of an intelligent EDS configuration selection assistant.

The EDS (Experiment Data System, developed by MIT) which processes the science data from PCA and ASM before inserting them in the telemetry, is a complicated piece of hardware and software that allows observations to be formatted in hundreds of different configurations. Although the underlying design is fairly simple, its intricacies will not be grasped readily by a casual guest observer. As such, it has indeed raised questions in the project.

Since the design is not that hard to understand, and it is only the sheer numbers (which, by the way, are needed to cover the full scale of X-ray sources) that make it difficult to obtain a clear view of the problem, it appeared logical to attempt to solve it in software.

Although this is outside my field of responsibility, strictly speaking, I felt I could make a useful contribution since I am the person who understands the EDS best in the XTE-SOC. I developed a tool that provides the user with a set of recommended EDS configurations, ranked according to suitability, on the basis of requirements provided by the user. Those requirements are

given in scientific terms: what time resolution does the user want; what spectral resolution; how much telemetry bandwidth is available; what are the characteristics of the source? In addition, it can optimize one or more of these, on the basis of boundary conditions set by the others.

It is very much like an Artificial Intelligence tool, employing fuzzy logic, that attempts to optimize the science as well as the use of telemetry. Tests were successful, though a little more tweaking of the parameters is required. It has also fulfilled an important function in that it has allayed any fears brought about by the imposing capabilities of the EDS.

## 2 Community

I participated in the EOSDIS peer review as a mail-in referee. I also participated as a reviewer in the large CAN peer review. Neither activity was charged to the task, though.

I continued as a member of the OGIP FITS Working Group.

## 3 Research

### 3.1 NGC 1961

Bill Pence and I have finished the first stage of the analysis of the ROSAT data on NGC 1961. For this analysis I made some significant improvements to an adaptive smoothing program written by Steve Snowden. Our primary interest in the data was to find an answer to the question whether an intra-cluster gas could be detected in this group that otherwise would be hard to stabilize, gravitationally. Previous authors believed that such was the case. The adaptive smoothing was essential to this work: the expected low, but extended, intensities of such a gas required heavy spatial smoothing; however, it was extremely important that the low-level features not be corrupted by point-like sources in the field. This can be achieved by adaptive smoothing. Snowden's algorithm works well for this purpose, but it is slow and produces rather annoying artifacts in the images it generates. I improved the speed

and added a cosine filtering to the algorithm. This took care completely of these problems.

The result was that we do not see any detectable amount of intra-cluster gas in the NGC 1961 group. An earlier claim that a bow shock can be seen around one edge of NGC 1961, evidence of its plowing into the intra-cluster medium, is clearly refuted by our data.

Preliminary spectral analysis of the X-ray source in NGC 1961 itself indicates a reasonable H column density, but a rather low temperature.

These results were presented in a poster at the AAS meeting in Minneapolis and at a Building 28 Atrium Tea.

### 3.2 Period Searching Algorithms

Now that Jim Lochner has implemented a first version of a time series data simulator, as well as a period search program based on Scargle's algorithm, I decided that the time is ripe for a formal research project aimed at investigating the effectiveness of various period searching algorithms. I have recruited the other scientists in the XTE-GOF for this project, and together we hope to be able to shed some light on this question by running a series of systematic tests on at least three algorithms: Scargle, period folding, and Gregory-Loredo. I intend to report on this at the HEAD meeting in November.

## 4 Next Quarter

During the next quarter I will continue the design of the FITS Data Finder which will act as a Data Base Management System for the hierarchy of XFF-generated FITS files. We will follow the general XFF development plan.

I will further pursue application of the Gregory-Loredo timing analysis algorithm in the context of the general period search testing project, mentioned above.

We hope to start on a paper on our ROSAT observations of the NGC 1961 group.

## Quarterly Technical Report

Eric M. Schlegel

Activity: 5030-04A-39

This report will cover the period of 1 April to 30 June 1994.

During the above named period, I have been working on a mixture of science and programmatic tasks. These will be outlined below.

### Science

A paper describing upper limits on the  $\gamma$ -ray emission from cataclysmic variables (CVs) has been submitted to ApJ for publication. A simple estimate indicates that CVs should be  $\gamma$ -ray emitters, largely due to Compton upscattering of ultraviolet photons off non-thermal radio electrons. The predicted fluxes lie above the sensitivity limits of the *Compton* EGRET instrument. No CVs have been detected with the resulting upper limits at least a factor of 5 below the predicted fluxes. The same team of investigators (E. Schlegel, P. Barrett (USRA), O. deJager (PU, South Africa), and G. Chanmugam (LSU)) has also acquired the COMPTEL instrument data. Again no CVs are detected. Both investigations are likely to spur additional theoretical work.

The *ROSAT* data on the galaxy NGC 6946 has been scheduled for publication in the October 20 issue of ApJ.

A paper has been submitted to AJ describing the X-ray emission of the historical supernovae present in the spiral galaxy NGC 6946. SN1980K, first observed with the *Einstein* IPC in 1980, appears to be visible as an  $\sim 3.5\sigma$  source. A prediction was made by R. Chevalier and C. Fransson in early 1994. The observed X-ray flux matches their predictions quite well. The other 5 historical supernovae were only present with upper limits.

A paper has been submitted to MNRAS describing the *ROSAT* PSPC observation of the eclipsing cataclysmic variable EP Dra. This CV is a magnetic system; the X-ray spectrum confirms this identification, showing the characteristic magnetic CV X-ray spectrum of a hard thermal bremsstrahlung component and a soft blackbody component. The X-ray light curve and hardness ratios show marginal evidence for structure in the emission region. The data are likely sufficiently strong to justify a proposal to use *ASCA*.

A paper is nearing completion describing the results of work done during the summer of 1993 with a student from the University of Maryland. We examined

the amateurs' databases on the dwarf novae VW Hyi and Z Cha (both southern hemisphere objects). The databases extend over 40 years, representing more than 10,000 visual observations of these two stars. The data have been analyzed and are presently being digested.

### Programmatic Tasks

During the above period, two key programmatic tasks were done: preparation for the XTE NASA Research Announcement and revamping the guest observer proposal preparation tools.

The XTE NRA will describe the satellite and instruments for potential guest observers. The official release date is 31 October 1994. The document must be presented to NASA HQ by 15 September 1994. The work done during the reporting period (i) defined the material that must be presented in the NRA, (ii) presented those definitions to the XTE science advisory board (18-19 May 1994), and (iii) made a start on preparing the text of the NRA.

In addition, based upon past experience with guest observers and their interaction with the proposal preparation tools, a decision was made to re-vamp those tools. The prime tool (known as RPS for Remote Proposal Submission) is a rather complex piece of software that makes it particularly difficult to alter for a new mission. The RPS "revamping committee" (of which I am a part) is charged with coming up with a different approach. One method to deal with the proposal handling will entail the use of a "e-mail talker", an e-mail response system that will help a GO generate a proposal with minimal difficulty on the part of the GO. A more complete description will be presented in the next technical report, as the details of the talker will have been refined by that time.

### Travel

I attended the Emission Lines meeting at Space Telescope Science Institute in May. I also attended the Cataclysmic Variable meeting in Padua, Italy during 20-24 June 1994. I presented the *ROSAT* PSPC data on the cataclysmic variables EP Dra (described above), MV Lyr, and KR Aur.

I also spoke to an elementary school during the reporting period. As part of my activities participating in the Science-by-Mail program, I was invited to speak before a class of 6th graders. I spoke about X-ray astronomy at NASA-GSFC.

### Tasks Planned

The following tasks are planned for the third quarter of 1994.

For science, I intend to work to complete the supernova X-ray review paper I am writing, likely destined for a review journal such as *Reports on Progress in Physics*. In addition, the following papers should be completed during this time:

the *ROSAT* PSPC data on SN1978K light curve (the first X-ray light curve), the VW Hyi/Z Cha data, and the identification of serendipitous sources in the fields of EP Dra and NGC 6946. I intend to submit proposals to use the *ASCA*, *HST*, and *Infrared Space Observatory* satellites. Finally, I am working with 3 summer students, the work of each likely leading to a paper. The next report will detail this activity.

The programmatic tasks on the agenda are the completion of the XTE GO proposal preparation tools and the completion of the *XTE* NRA. The due date for a draft of the NRA is 15 July.

Two meetings are on the agenda for attendance: first, a meeting on circumstellar matter during 28 Aug-2 Sept in Edinburgh, and the data analysis meeting in Baltimore in mid-September. The first meeting is directly related to my science interests and the second is a programmatic meeting.

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July 15, 1994

To: Crystal Wheatley, USRA.

Re: Quarterly technical report, 4/1/94 - 6/30/94.

XTE: This quarter I continued to manage the XTE Guest Observer Facility, my prime programmatic responsibility. This position involves everything from manpower and hardware budgeting and heavy politicking, overseeing the efforts of the other three GOF scientists and several programmers, interfacing with the HEASARC on file formats, archiving, and PR, and with the Astrophysics Data Facility in Code 631 on data processing, security and distribution, attending the Science Working Group and Instrument Team meetings and chairing my own GOF meetings, making decisions on scientific and operational aspects of the XTE mission, and selecting the color and location of furniture. This quarter I also chaired the selection committee for the post of SOF Chief Duty Scientist, which involved interviewing five candidates, attending their colloquia and chairing meetings to discuss the candidates and arrive at a recommendation. This added up to a quite sizeable chunk of time.

Aside from the general management of the GOF, I am also responsible in particular for the data preparation, selection and analysis portions of the software. This quarter we developed an enhanced version of the core SAEXTRACT code which takes the complex 2D-array FITS files ("science array" or SA files) created by XFF and accumulates spectra and/or light curves with options to filter based on channel (energy), time, and phase. This code is also being used for ASCA GIS MPC data and archival Einstein SSS data for which the same FITS format has been adopted. Codes to operate on event data, and to expand both SA and SE files for easy operation by other FTOOLS have also been completed on schedule during this quarter, and work done on a program which will operate on the rather complex 'Transparent mode' data and produce 'sensible' FITS files.

This quarter I also expanded my own programming education by writing the first FTOOL in the C programming language. I learned a lot by doing this, and as many

more FTOOLS will be written in C in the future this was a generally very useful thing to do. I will be expanding the code to form the core of the XTEFILT task, which creates a so-called XTEFilter file containing pointing and orientation information, instrument housekeeping parameters, and various derived quantities such as the sun angle and Earth limb angle, the McIlwain L and B parameters and other things connected with the radiation environment of the spacecraft. This XTEFilter file is used by the data analysis software for 'cleaning' the data and for complex selection of subsets of data during analysis, and it has to be constructed by consolidating information from many different sources, interpolating where necessary, and calculating other quantities using spherical geometry and coordinate conversions, etc.

The closure date for deliveries of Build 3 of the GOF software was the end of April, with final, debugged, integrated and functional systems by the end of May. We achieved all the items on our Build Plan, with the exception of a few calibration tools which require further input from the instrument teams at MIT and UCSD. (The instrument teams are responsible for the calibration of their instruments, and the GOF has the responsibility for incorporating this calibration information into FTOOLS which can be distributed to the community.)

In May I attended the AAS meeting in Minneapolis and manned the first XTE GOF booth, along with Jim Lochner who performed the lion's share of the effort to create the displays for this booth. We answered many, many questions from prospective XTE proposers who stopped by the booth to take a brochure and learn about the mission.

At the end of the quarter I performed what may be my most valuable role in the long run, which is to fight for the resources the XTE GOF needs. The continuing cuts to the XTE post-launch MO&DA budget require effort on my part both to assess the effects of the cuts, redistribute resources, and help the SOC Director and XTE Project Scientist in their efforts actively campaign for XTE funding. Most recently we have been asked to come up with a revised plan for the SOC in the event of a 20-25% cut in funding, and I am a leading player in that effort. At the end of June I gave a presentation to the SOMOWG (the working group appointed by NASA HQ to advise on Science Operations issues) in which I described the current SOF and GOF plans and spelled out in detail the consequences of the proposed cut. As a result, the SOMOWG adopted a strongly-worded resolution to NASA HQ recommending that XTE should take no further cuts.

**ASCA:** The work on the analysis of X1820-303 (described last month and presented at the AAS meeting this quarter) is continuing slowly; certain difficulties with the observing modes selected for this extremely bright source require some attention to subtle calibration issues which will take some time to resolve. In the meantime, I have also done a first-cut analysis of the data from Cyg X-2, and have submitted the following abstract for the High Energy Astrophysics Division meeting in November of this year, entitled "Observations of Cygnus X-2 with ASCA and BBXRT" by Smale, Mitsuda and Dotani (the latter from ISAS, Tokyo, Japan):

"Cygnus X-2 was observed on 1993 June 18-19 for 29 hours using the ASCA GIS and SIS detectors. The observation covered orbital phases  $\phi=0.99-0.12$  of the 9.84-day binary cycle (where  $\phi=0.0$  is the inferior conjunction of the neutron star). The deadtime-corrected 2-10 keV intensity of the source is  $9 \times 10^{37}$  ergs s<sup>-1</sup>, placing it at the edge of its transition between phase-dependent and non-phase-dependent behavior

(Vrtilek *et al.* 1988, ApJ 329, 276), and irregular dipping activity is observed with dip durations of order 1000s and depths of 15–20%, superimposed on a smooth longer-term variation of  $\sim 8\%$ . The dips are not associated with an increase in absorption, and we see no correlation between intensity and hardness. This and the shape of the color-color diagram imply that the source was observed in a interval of relatively stable accretion, probably on the Horizontal Branch of its Z-diagram.

“The GIS PH data have a non-standard bit assignment to increase the temporal resolution and facilitate QPO studies, while the SIS data were in FAST mode. Some calibration issues thus need to be resolved, however a preliminary spectral analysis shows that the continuum can be modeled using a Comptonized component with  $kT_{ee}=1.3$  keV and  $\tau=22$ , plus a blackbody with  $kT_{bb}=0.55$  keV. A more complete study of the line and continuum emission and QPO behavior of Cyg X-2 will be presented at the conference.

“The ASCA Cyg X-2 data nicely complement the observations made in December 1990 with BBXRT (Smale *et al.* 1993, 410, 796), during which the source was in a high state on the lower portion of the Normal Branch and displayed a well-resolved iron line at 6.7 keV. An intercomparison of the results from the two datasets will be presented.”

My work on 1E2259+586 (the pulsar in a supernova remnant) with Robin Corbet of Penn State University is proceeding steadily and we now have a first draft completed entitled: “ASCA and BBXRT Observations of the 7 Second X-ray Pulsator 1E2259+586”. I will supply an abstract of this paper on submission.

**Conferences, travel:** I attended the AAS meeting in Minneapolis, Minnesota at the end of May, where I manned our new XTE booth and presented a paper on the X1820–303 ASCA data described above and in previous quarterly reports.

**Science:** My main effort this quarter was in analyzing the ASCA data described above. In addition, our comprehensive paper describing the calibration of the BBXRT detectors (“Calibrating BBXRT” by Weaver *et al.*) has been accepted by the Astrophysical Journal Supplement.

During the next quarter I will continue to manage the XTE GOF, continue my own programmatic work on developing FTOOLS and XSELECT to run on XTE data, with particular emphasis on the construction of the XTEFilter file (see above); help with feasibility calculations for XTE observations to assist with the construction of the NRA technical appendix; edit the first edition of the XTE Newsletter; and do further ASCA data analysis.

Please contact me if further details are required,

Dr. Alan P. Smale

USRA REPORT 4/1/94 - 6/30/94  
Dr A.B.Giles  
Employee Task No: 93-05-00

During the above period Dr Giles continued as the Software Manager for the PCA experiment software development and deliveries to the XTE Science Operations Center. He also continued to support the Goddard team developing the PCA detectors for the XTE satellite.

**Meetings:-**

Dr Giles regularly attended the following list of meetings at GSFC in connection with the PCA experiment:

PCA software deliveries to SOC (Chair)	alt. Wednesdays
PCA representative on the SOC meetings	alt. Mondays :
PCA full team group meeting	every Friday
PCA representative on GOF meetings	occasional

Other specific meetings were:

SOC Science Monitoring subsystem review	12 April	STX
Instrument Teams (IT)	20 April	STX
5th Instrument Operations Working Group	21 April	GSFC
Demo of Build 3 deliveries for PCA team	4 May	GSFC
XTE project review for IT/SOF	16 May	STX
6th Instrument Operations Working Group	17 May	GSFC
XTE Science Working Group (SWG)	18-19 May	GSFC
Instrument Teams (IT)	13 June	STX
7th Instrument Operations Working Group	14 June	GSFC

**Conferences:-**

None

**Travel:-**

None

**Activities:-**

As PCA Software Manager Dr Giles major activity of the period was the preparations and deliveries for the XTE SOC Build 3. All the required documentation was delivered on time at the end of March and most code items for the end of April. A few code items were deferred to Build 3.1.

Excellent progress has been made on the main three subsystems PCA are developing:

- a) Command Generation - this has been a mature subsystem for some time and is now almost complete. It will first be used to command the PCA experiment during the 2nd Hardline Data Flow in mid-July.

- b) Health & Safety (housekeeping monitoring) - this subsystem has made rapid progress since the re-design and will have extensive capability for the Build 3.1 delivery. Additional features have been designed by Dr Giles and will take most of 1994 to implement.
- c) Science Monitoring - has also made rapid progress since its re-design and STD modes 1 & 2 for the EDS will be essentially complete for Build 3.1. Dr Giles is now doing the design for the additional EDS modes for implementation during Build 4.

Dr Giles and the PCA programming team have continued to play an important role in assisting the SOC by remaining at the "leading edge" of the IT interfaces to the SOF and hence acting in many ways as "trail blazers".

The XTE Project Office have remained active in monitoring the progress of the instrument teams and required numerous inputs from Dr Giles. He prepared pert charts for the period till March 1995 and presented them at the project review on May 15th.

As Software Manager Dr Giles continues to coordinate the work of the following programmers:

Aileen Barry	Hughes STX	INT (moving to GOF support)
Hwa-ja Rhee	Hughes STX	PCA Science Monitoring - SOF
Vikram Savkoor	Hughes STX	PCA Commanding - SOF
Ramesh Ponneganti	Hughes STX	PCA Housekeeping - SOF
Mike Stark	UMD	PCA background modelling - GOF

The search committee for an additional PCA scientist, with Dr Giles as the Chairman, interviewed several candidates and selected Dr Tod Strohmayer who is expected to arrive at GSFC on 5th July. He will work on PCA FITS and FTOOL calibration deliveries to the GOF. Due to limited manpower these areas have been somewhat neglected to date.

#### **Documents:-**

The following documents have been updated or enhanced:

PCA Housekeeping - Status, Suggested Screen Layout, Recall Modes, SOC Interface, PCA-HK-EXP-V3.1, May 26th 1994, A.B.Giles (79 pages).

PCA Commands - Types, Sequences, Use, Suggested Screen Functions, Configuration Verification, SOC Interface, PCA-COM-EXP-V3.1, June 30th 1994, A.B.Giles (47 pages)

PCA Science Monitoring - Design Concepts, Screen Functions, STD Modes 1 & 2, SOC Interface, PCA-SM-EXP-V3.1, June 30th 1994, A.B.Giles (94 pages)

PCA Telemetry Simulator - Housekeeping generator for PCA & SOC Software Testing, PCA-SIM-EXP-V3.1, June 8th 1994, A.B.Giles (34 pages)

Two chapters for the SOC NRA, due out in late November 1994, were coordinated by and written in part by Dr Giles:

- a) The "final version" of the PCA Instrument Description chapter (22 pages) was delivered on 6/10/94
- b) The draft of the PCA Feasibility chapter (11 pages) was delivered on 5/31/94

The first draft of the "Instrument Operation Users Guide" (56 pages) was prepared by Dr Giles and delivered to the IOWG on 4/29/94.

Dr Giles also made a substantial review of the current XTE Project Data Base (PDB) entries for PCA housekeeping telemetry. Corrections and additions were delivered on 5/26/94.

#### **Publication Activities:-**

Dr Giles continues to work on the Rapid Variability Analysis paper mentioned in previous quarterly reports and some progress has been made. Dr Giles hopes to present a version of this paper at the ADASS conference in Baltimore during September 1994.

Dr Giles is presenting a paper on XTE to the Astronomical Society of Australia Annual Conference in Canberra in July 1994. The paper is entitled

"Prospects for Co-ordinated Observations with XTE"

The PCA group presented posters at the AAS meeting in Minneapolis during June 1994 and will also be presenting a paper at an X-ray conference in the Hague in August 1994. Several other papers resulting from PCA calibration activities are in the early stages of preparation.

#### **Next Quarter:-**

Dr Giles principal activity for the next quarter will be to complete the SOC-PCA delivery schedule for Build 3.1 and proceed onto Build 4. Build 3.1 is relatively short with documentation due by the end of June and code by the end of July.

The next science integration test occurs in mid-June and the opportunity will be taken to test advance versions of our Build 3.1 code in a "realistic" setting. All 5 PCU's are now on the XTE spacecraft.

# Quarterly Report: 1 April through 30 June 1994

Weiping Zhang

## Introduction

This quarter, like the last one, has seen the most intensive XTE/PCA activities. I have worked in many fronts. In a report of this size I can only give a very brief summary of the most interesting activities that I have been involved in.

## Detector Performance Evaluation

The detector breakdown problem as reported in my last quarterly report has cured successfully during this quarter after implementing the systematic scanning technique. We found many bad wires which had to be replaced from at least two of the five detectors.

During April and June we conducted two spacecraft system level test with the PCA instruments and its associated data acquisition system as built by MIT. We tested the many science events modes that are in existence in the experimental data system and the many features of the PCA proportional counters. The tests were big successes.

In addition, we also conducted the end-to-end timing test. It is important to verify the accuracy of the spacecraft clock. Using a mechanism I devised a year ago, we successfully verified the clock accuracy to 1 microsec.

Meanwhile we also found that the propane layer resolution deteriorates with time. This degradation of resolution significantly hampers the ability of the instrument to reject cosmic background particles. I devised a new mechanism to replenish the propane gas so that the gas in the detector will remain pure and thus maintain the good resolution for longer period of time.

## Calibration and Characterization

This is a continuation of the same activity from last quarter. Using the beam facility on top of Building 2 at GSFC, I have checked into the uniformity of 5 of the 6 XTE/PCA proportional counters. The last one will be checked in the next few weeks. For doing the check, I developed many software tools and give necessary scientific supervision and advice to the technicians involved. In short, we verified the following: (1) Detector gain under vacuum and low temperature; (2) Detector resolution under vacuum and low temperature; (3) Collimator responses; (4) X-ray throughput directions.

In addition, I have started a collaboration effort with Dr. Dick Deslotes of the National Institute of Science and Technology to build a monochromator for calibrating the PCA proportional counters. I expect we should be able to build a completed monochromator in the next few months.

## Research Activity

My activities on research are direct continuations from the last quarter. Among all the hectic activities I managed to find some time to think about science which is the thing I am interested

most. In collaboration with Jean Swank, who is my NASA task originator, I am writing a paper on a new method measuring the neutron star period in low mass x-ray binaries.

Also in collaboration with Ed Morgan of MIT, I am writing a paper on some techniques of doing Fast Fourier analysis.

Also I am preparing to start writing proposals for the XTE/PCA observations. I have had quite a few ideas worked out and need to turn them into some concrete proposals in the next few months.

In addition, I contributed a paper to the International Astronomical Union 165th Symposium to be held in the Hague, the Netherlands, from August 12 through 19 this year. In the paper I describe the characteristics of XTE/PCA and the many potential sciences that the guest observers can do.

Quarterly Technical Report  
(1 April - 30 June 1994)

Name: Wan Chen  
Position: Research Associate  
Task Number: 5000-643  
Date: 26 July 1994

Work accomplished:

- [1] On the Optical Counterparts, Long-Term Variabilities, Radio Jets and Accretion Sources in 1E 1740.7-2942 and GRS 1758-258, Wan Chen, Neil Gehrels and Marvin Leventhal, 1994, ApJ, May 10, Vol. 4, p.
- [2] Study of the Correlation between COMPTEL Al<sub>26</sub> 1.8 MeV Map Features and Galactic Spiral Arm Structure, a research proposal submitted to NASA GRO Cycle 4, Wan Chen, Neil Gehrels, Roland Diehl, and Uwe Oberlack, 11 April 1994.
- [3] Understanding the COMPTEL <sup>26</sup>Al 1.8 MeV Map Features, Wan Chen, Neil Gehrels, and Roland Diehl, submitted to ApJ Letters, 15 June 1994.

Work in progress and planned for the next quarter:

1. Compilation and classification of all known X-ray nova light curves and a complete review of the current theory and observations of X-ray nova, an ApJ paper in preparation with Chris Shrader, Jim Lochner, and Mario Livio. Preliminary results were presented at the 4th Annual October Astrophysics Conference in Maryland (1993): The Evolution of X-ray Binaries and at the 183rd AAS Meeting in Washington D.C. (1994). This work will also be reported in IAU Symposium "Compact Stars in Binaries" to be held 15-19 August 1994 in Hague, The Netherlands.
2. A New Model of Nonthermal Synchrotron Radio Emission from Massive Stellar Winds, an ApJ paper in preparation with Richard L. White.
3. Understanding the Black Hole X-ray Novae Using Disk Instability Models, an ApJ paper in preparation with John Cannizzo and Mario Livio.
4. Search for 1.8 MeV Emission of <sup>26</sup>Al from Nearby Supernova Remnants, an ApJ paper in preparation with Neil Gehrels, Roland Diehl, and Uwe Oberlack.

From: Dr. Eric R. Christian  
NASA/GSFC Mail Code 661

July 15, 1994

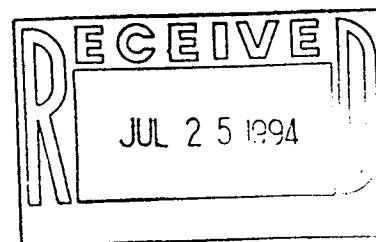
**Quarterly Technical Report**  
2nd Quarter, 1994

**ALICE (A Large Isotopic Composition Experiment):** ALICE is a balloon-borne experiment designed to measure the elemental and isotopic composition of galactic cosmic rays in the charge range Silicon to Nickel between 400 and 800 MeV/nucleon. It is a collaboration with the U. of Siegen in Germany. A paper on the isotopic composition of Silicon and Iron (abstract enclosed) has just been submitted to Astrophysical Journal. Although I am not first author on this paper, I have been very active in the data analysis, writing and editing of this paper (and am the first US author). Getting this paper published will probably be the last of my ALICE work.

**Voyager Cosmic Ray System:** I continue to work with Drs. Ed Stone and Alan Cummings of Caltech on a paper for the Astrophysical Journal. We have decided to include more recent data which is now being analyzed. The first look at new data looks very good (analyzed during a trip I took out to Caltech this last quarter) and I presented a paper (which was received very well) at the Pioneer-Voyager Symposium on the Outer Heliosphere (U. New Hampshire) which I attended this quarter (abstract enclosed).

**IMAX (Isotope Matter-Antimatter eXperiment):** IMAX is a balloon experiment which we are working on with Caltech, U. of Siegen, and NMSU to measure the fluxes of anti-protons, and Hydrogen and Helium isotopes over a wide energy range. During this quarter, I have continued to work on the analysis of the data from our successful 1992 flight. I am responsible for the energy loss measurement in four scintillation counters, including mapping and other calibrations and corrections. This work will continue over this entire year. Preliminary science results were presented at the annual meeting of the American Physical Society in April (Washington DC). We hope to start writing the refereed papers this next quarter. An instrumental paper was accepted for publication in NIM (abstract enclosed).

**TIGER (Trans-Iron Galactic Element Recorder):** TIGER is a balloon experiment designed to look at ultra-heavy galactic cosmic rays. It is an collaboration with Washington U. (St. Louis) and U. of Minnesota. Our counters are ready but due to delays at Wash. U., the flight has been delayed until summer 1995. This project will remain at a low but constant level of effort until full integration next spring.



ISOMAX: This is another magnetic spectrometer balloon experiment in collaboration with Caltech and U. of Siegen. It is specifically designed to look at the isotopic composition of Beryllium, because  $^{10}\text{Be}$  is a very important clock that can measure the lifetime of all cosmic rays. Because  $^{10}\text{Be}$  is a rare isotope, the experiment is being designed for long duration flights from Antarctica or Greenland, although the first flight in 1995 is planned for Canada. I am responsible for the onboard command and data handling (C&DH) system and the ground support equipment (GSE). During this quarter, I finished design of the GSE and photomultiplier magnetic shields and began purchase and/or construction on both, and programming for the GSE. A prototype C&DH system is now undergoing test under my supervision.

ACE (Advanced Composition Explorer): ACE is an Explorer that is planned for launch in 1997 to study the solar wind, and heliospheric and low energy galactic cosmic rays. I am the Assistant to the Project Scientist (Jon Ormes). This requires spending considerable amount of time in meetings and facilitating communication between the project management here at Goddard, the spacecraft contractor (the Applied Physics Laboratory), and the experiment teams. I am also on the science team for two of the instruments onboard. During this quarter, the amount of time I've spent working on ACE has increased, and this will continue into the next quarter. I am a member the ACE Mission Operations Working Group, the Initial Operations Working Group, and the Spacecraft Operations Working Group, all of which meet monthly. I also attend weekly project meetings and the monthly APL status meeting. During the last quarter, I attended a Preliminary Design Review for SEPICA (UNH). Also this last quarter, I started writing a monthly "What's New on ACE" newsletter for the science team.

I have also been working with Drs. Dan Baker (NASA/GSFC) and John Cooper (NSSDC) on some theoretical work on solar modulation. We are attempting to gain insight into modulation processes by treating the heliosphere in the same way planetary magnetospheres are treated (which are their specialty). During the last quarter, our paper on electron modulation (enclosed) was refereed and accepted for publication in Space Science Reviews. I am first author on this paper.

On top of all this, I am the system manager for the new UNIX computer system the group has bought for use in IMAX and ISOMAX data analysis. As

part of this, I am giving a series of lectures to the group on the new software and environment.

## QUARTERLY REPORT OF BRADLEY E. SCHAEFER FOR APRIL-JUNE 1994

I have been continuing with the task of BATSE data analysis and BSAS programming tasks. For the programming tasks, these have included testing a new robust version of CONF, searching for a transient error in MATRIX, and testing LSRCH. For the BATSE data analysis, I have been comparing the BATSE SD spectra with Ulysses and Ginga data. I've completed my study of the cross calibration of BATSE, COMPTEL, OSSE, and EGRET, with a very good agreement between all. I have run the Target-of-Opportunity rapid response burst search twice during this period, but no fading counterpart was identified. I have started a collaboration with Dorrit Hoffleit (Yale) regarding optical transients. I travelled to NC State, UCLA, Yale, and Bartol to give talks on Gamma Ray Bursts, while Goddard invited me to present the center's Science Colloquium on 22 April. On my UCLA trip, I had long discussions with a group at CalTech who adopted my idea for a STEDI mission, and I am now on their 'Board of Directors'.

Several weeks ago, Yale University made me a generous offer to be a professor of Physics, and I have accepted. So I will leave this job and start at Yale on 11 September 1994.

□

TO: David Holdridge/610.3, USRA  
FROM: Scott Barthelmy/661  
RE: 2nd Quarter 1994 Report

06 Jul 1994

This report describes 4 areas of activities: the Gamma Ray Imaging Spectrometer (GRIS), the BACODINE project, the Gamma ray To Optical Transient Experiment (GTOTE), and several miscellaneous activities. My effort was split approximately 5/75/15/5. The activities described below are mine either directly or through the supervision of others. For the GRIS project there is one other scientist whose efforts are in other areas and are not described here. There are no other scientists contributing on the BACODINE project.

#### **GRIS project activities:**

Very little was done on the GRIS project this quarter. My paper on the results of the isotopically enriched Germanium for background reduction appeared in the May 20 issue of Astrophysical Journal (see attached reprint).

#### **BACODINE project activities:**

The BACODINE project continues grow. There are currently 16 operations receiving GRB locations at 20 sites with 23 instruments. Two of the sites are fully automated, thereby having response times of seconds. The operations span the energy range from radio, microwave, optical, and even the gamma ray band. Given the recent discovery by the EGRET team that at least 2 GRBs have very high energy gamma ray emission ( $>1\text{GeV}$ ) for up to 90 minutes after the initial BATSE detection, the WHIPPLe (Harvard-CfA) TeV, ground-based, gamma-ray telescope has joined the list of BACODINE collaborations.

The "level 1" version of the coordinates calculation algorithm is functioning routinely. The U. of Maryland physics grad student, James Kuyper, is continuing his Fall work this Spring & Summer semesters. He has been working on the code which corrects the position determination for the non-cosine( $\theta$ ) detector dependencies and the earth atmosphere scattering correction.

I traveled to LLNL in Livermore, CA, to visit with the GROCSE instrument team (LLNL, U. of Michigan, GSFC) for a team collaboration meeting. Next quarter I will be attending the Santa Barbara Astronomy Group (SBAG) team meeting at Alfred University to discuss BACODINE participation. SBAG is a group of very serious amateur astronomers that have a long history of participating in GRB follow-up observations in the professional arena.

I submitted the "renewal" proposal for BACODINE to the GRO Guest Investigator Phase 4 cycle. As part of the GROCSE/BACODINE collaboration, I am Co-I on 3 other GRO GI Ph4 proposals: with LLNL, with U. of Michigan, and with UC at Riverside.

#### **GTOTE project activities:**

This project has maintained a high level of effort. An electronics engineer and two E-techs are assigned to the project. The PR for the CCD camera (the last subsystem to be obtained) was placed in Jun and should be delivered in Jul/Aug. John DiFelici (hired as a consultant through USRA) continues the software development for the system.

#### **GRB Follow-up Proposals:**

There were 3 close calls, but I did not invoke my ToO proposal on the KPNO Schmidt telescope. There was no IPN or COMPTEL positional information to correlate with the BACODINE information to reduce the error box to be suitable for the Schmidt.

**Talks:**

I presented a "Status Report" talk on BACODINE at the March 94 APS conference.

**Other Porposals:**

I am Co-I on 2 GRO GI Ph4 proposals: titled 1) "Improving BATSE's Threshold with Archival Data" (B. Schaefer is PI), 2) ."Deep Optical Search Project" (B. Schaefer is PI).

## Quarterly Technical Report

David Palmer  
April - June, 1994

During the past three months I have been involved in four projects, namely:

- 1) Analysis of Gamma-Ray Burst (GRB) data from the BATSE SD instrument on Compton Gamma-Ray Observatory (GRO);
- 2) Search for radio counterparts of GRBs;
- 3) Preparation of the Transient Gamma-Ray Spectrometer (TGRS) for launch on the WIND spacecraft, scheduled for November 1994;
- 4) Miscellaneous.

### BATSE Spectroscopy Detector Analysis

The main focus of the BATSE SD analysis effort has been the search for spectral lines in GRBs. This quarter, I completed (as primary author) an Astrophysical Journal Letter summarizing the search so far. The letter has been accepted and will appear in or around September. So far this search has found no absorption line features.

I am continuing to search new bursts as they occur to look for lines.

### Search For Radio Counterparts of GRBs

I have been searching for radio sources affiliated with gamma-ray bursts. The emission could be from the burst process itself, the object which produces the burst, or the host galaxy (or other system) in which the burst source resides. Most of my work on this has been using the Very Large Array radio telescope to search GRB positions 23 hours to 14 years after a burst had occurred.

I visited Cambridge, England, to work on the Cambridge Low Frequency Synthesis Telescope (CLFST) which has a large field of view, and will therefore serendipitously observe GRBs. During my visit there we developed observing techniques to expand the telescope's field of view, thereby increasing the number of GRBs which would happen to occur in the telescope's sight, and to rapidly repoint the telescope in response to GRBs, which would allow targeted observations to begin minutes after the GRB occurs.

A paper describing a serendipitous CLFST observation of a GRB location shortly after the burst occurred has been accepted by Monthly Notices of the Royal Astronomical Society. A letter to Nature has been submitted describing a multi-instrument (including CLFST) observing campaign following a GRB.

My focus in the coming quarter will be a final reduction of all VLA data and the production of a paper describing the results. So far, I have been able to

produce upper limits on radio production of GRBs or their host objects or galaxies in the 21 cm and 3.5 cm bands.

### **TGRS Preparations**

I have been involved in the testing and debugging of a module of on-board spacecraft software which folds TGRS data at a pulsar frequency. This module, for which I wrote the specification last year, provides a capability previously absent from TGRS.

I have also been involved in the data analysis software (running on computers on the ground) for this instrument.

Launch of the WIND spacecraft is scheduled for November 1994. The political status of the spacecraft is such that the schedule will probably be met.

### **Miscellaneous**

I participated in the review of phase 4 GRO guest investigator proposals. I evaluated 48 proposals, and was the primary or secondary reviewer of a dozen of these. On June 27-28 I participated in the committee meetings to rank these proposals for funding and observing time priority. This is the scientific equivalent of jury duty.

A handwritten signature in black ink, appearing to read 'David Palmer', with a stylized, flowing script.

David Palmer

# USRA Technical Report (2nd Quarter, 1994)

Helmut Seifert (Task Number: 660-044)

## Task Description:

I have been leading the Transient Gamma-Ray Spectrometer (TGRS) software development, and am responsible for all the software requirements/specifications and documentation. I am also responsible for the design and testing of the algorithms used by the software. Similar work is done by me also for the KONUS instrument. I am taking an leading part in the laboratory testing of the TGRS analog/digital flight electronics and software. I am responsible for formulating and conducting all the instrument tests and calibrations during the integration and calibration phase of TGRS, as well as for the design of the procedures used during the actual flight mission.

## Activities:

From 24–27 May 1994 I traveled with our Analog Electronics Engineer to Martin-Marietta (former GE Astro) in East Windsor, NJ, to witness and assist in the reintegration of the TGRS detector/cooler assembly onto the WIND spacecraft. At this time we also did another noise test with the warm unbiased detector and the spacecraft.

During refurbishment in November of 1993 one of instrument flight harnesses had been reworked to address the noise problem, and we had installed filters for the temperature sensor and heater wires. Better grounding schemes for the heater returns (open, or via a 100 k $\Omega$  resistor to digital ground), which we had found with our setup in the lab, were not approved by the Project Office and could not be made available for flight. The new test on the spacecraft didn't show any of the periodic noise signatures (e.g. 50 kHz) which we had observed previously in December of 1993. This showed that the filters in the harnesses performed as desired. On the other hand, however, we could not reproduce the good noise performance which we had obtained with our preferred grounding configuration in the lab. Therefore, it was proposed to have the option to test our preferred grounding scheme on the spacecraft. This test had to be coordinated with WAVES which is one of the other experiments on the WIND spacecraft, and which is most sensitive to any changes in the grounding

configuration. Also a special breakout box with the various grounding configurations had to be built and tested.

On 17 and 18 June 1994 our Project Manager and I tested the two preferred grounding configurations on the spacecraft, found however no difference with respect to noise performance. After this test result, it is now hoped that whatever (white) noise remains at this point is merely due to the fact that we are dealing with a warm and unbiased detector/preamp system, a system which operates outside its design envelope and is very sensitive to noise pickup. So we hope that the noise will either be less or go away altogether when the system is cold and biased.

From 6-13 June I supported a Mission Profile Test (MPT), a Flight Procedures Validation & Verification (V&V) Test, and a Mission Initial Instrument Activation Simulation from the POCC at NASA/GSFC.

For these latter tests and for preparation of the actual Flight Operations I went to several reviews of the TGRS procedures, telemetry, command, and constraint database by the Flight Operations Team (FOT). Apart from two still outstanding microprocessor loads plus associated procedures, all issues relevant for the mission and early flight operations are thus resolved now. The two microprocessor loads are actually patches of the flight software, one of which corrects a bug in which certain types of events were not handled correctly by the software. The other load is a patch which adds two additional features to the software, namely logarithmically binned sectorized windows histograms and a "pulsar mode." Also, a patch which checks the correct upload of the software was developed. The loads are still under extensive evaluation in the laboratory by me, and need to be tested and delivered by middle of July 1994 for inclusion in the final Added Confidence Test (ACT) in August.

Apart from the above I continued work on the development of the TGRS data analysis software. This involves regular meetings and discussions with the programmers. Good progress has been made in the last quarter and we have now working (for some programs initial) versions of the most crucial programs. Monte-Carlo simulations of the TGRS instrument have begun using the GEANT software from CERN. This work will be crucial for the interpretation of our measured data in flight and also for the design of future detector systems.

I will continue with the same activities during the 3rd quarter, and also support several upcoming tests of TGRS and the WIND spacecraft at Martin-Marietta. The WIND launch has now been fixed to 1 November 1994.

UNIVERSITIES SPACE RESEARCH ASSOCIATION  
GODDARD VISITING SCIENTIST PROGRAM

QUARTERLY TECHNICAL REPORT- Second quarter of 1994 - 6/10/94

Employee Name: John W. Mitchell    Task Number: 660-018

During the past quarter my primary activities were development work for the ISOMAX balloon program, analysis of the 1992 IMAX flight, preparations for the WiZard 1994 balloon campaign, analysis of data from accelerator experiments, and development work on new flight and ground based experiments. Also, during the past quarter, I worked on preparing three new papers for publication.

ISOMAX - Isotope Magnet Experiment: I am Instrument Manager for ISOMAX, which is being developed by GSFC, Caltech, and the University of Siegen (Germany). In this capacity, during the last quarter, I worked on a variety of experiment issues including instrument configuration, electronics, power, and structure.

The instrument is based on a new large superconducting magnet, for which I am directly responsible. During the past quarter the contract to build the magnet was awarded to Oxford Instruments. I have been working with Oxford on the magnet design to insure that it will meet our dimensional and performance needs.

There have been a number of evolutionary developments in the ISOMAX instrument design during the past quarter. I have been coordinating these developments. I have also maintained a CAD model of the instrument configuration as well as simulations of the instrument performance.

I am also responsible for the time-of-flight system and the experiment electronics, including development of new low-power flight systems. During the past quarter I worked on the continuing development of hardware for the low power electronics, in particular a charge-sensitive amplifier system for use with the Cherenkov detectors.

ISOMAX activities will occupy most of my time during the next quarter.

IMAX (Isotope Matter-Antimatter eXperiment) - This instrument was built and flown by GSFC, Caltech, NMSU, and the University of Siegen (Germany).

I am working directly with two graduate students, Wolfgang Menn and Olaf Reimer, at the University of Siegen, Germany, analyzing the IMAX TOF and aerogel Cherenkov detectors. This work will continue during the next quarter. In addition, the collaboration is beginning to move from detector analysis to physics analysis. I expect to be heavily involved in that process.

During the past quarter three IMAX papers were presented at the Spring Meeting of the American Physical Society at Crystal City, VA. I gave the primary IMAX instrument paper.

MASS/WiZard: The WiZard-Related Balloon Program is conducted by an international collaboration with researchers from the U.S. (NMSU and GSFC), Italy, Germany, Sweden, India, and Russia. During the past quarter I participated in preparations for a flight to take place in summer, 1994. This flight features a new ring-imaging Cherenkov detector, and is known as CAPRICE. My responsibilities in this experiment are the time-of-flight system and the trigger electronics.

I will be traveling to Lynn Lake, Manitoba, Canada on June 16, 1994 to participate in final preflight preparations for the CAPRICE (WiZard) flight.

SMILI (Superconducting Magnet Instrument for Light Isotopes): The SMILI instrument flew twice: in August, 1989, and in August, 1991. During the past quarter analysis continued on data from both flights.

E878 (ANTI): This is a program of experiments at the Brookhaven National Laboratory Alternating Gradient Synchrotron (AGS) to obtain the heavy-ion-collision production spectrum of pions, kaons and antiprotons in the energy range from 1.5 GeV to 24 GeV. E878 will also conduct a high statistics search for the production of antideuterons or exotic particles in this energy range.

During the past quarter, I participated in analysis of E878 data.

Two E878 papers were presented at the 1994 Spring Meeting of the American Physical Society. In addition, a preliminary E878 paper was published in Nuclear Physics.

Experiments E683H and E849H: The results from E683H are now being prepared for publication. The publication has reached a final draft stage and it is expected that it will be submitted to the Physical Review during the next quarter.

Experiment E938H (Transport Collaboration): During the past quarter, I participated in the analysis effort and in other collaboration activities. In particular, I directed a post-doctoral researcher from the University of Catania, Sicily, Jan Romanski, in improving the calculations of the particle flight times. I also worked on modeling the instrument acceptance as one of the final steps in preparing for publication. Work will continue in both of these areas during the next quarter. The time-of-flight work will be carried out in conjunction with Louisiana State University and I will be directing the efforts of a graduate student and a post-doctoral researcher there.

During the past quarter, I participated in a Transport collaboration meeting at University of Minnesota. At this meeting plans were made for a new Transport proposal, to be submitted to NASA in August, 1994. Three E938H papers are in final preparation and were discussed at the collaboration meeting. It is expected that at least two of these papers will be submitted during the next quarter.

TIGER - Trans-Iron Galactic Element Recorder: This experiment is conducted by a collaboration between Washington University, the University of Minnesota and GSFC. During the past quarter, I worked on TOF system development and testing as well as in general experiment planning. I also worked on the experiment electronics. It is planned that the first flight of the instrument will take place in summer, 1995.

BESS - Balloon-Borne Experiment with a Superconducting Solenoidal Magnet Spectrometer: The BESS experiment is a search for low energy antiprotons and antihelium at a sensitivity much greater than current upper limits. BESS will be flown for the second time in July 1994. A paper on BESS was presented at the 19th. International Symposium on Space Technology and Science, Yokohama, Japan 5/94.

E896 (H0): This is a new experiment to search for the H0 dibaryon. The H0 is a six quark MIT bag (uuddss) that is predicted to be produced in great numbers in heavy-ion central collisions. However, it has a short lifetime and has not been detected as yet. The proposed experiment will conduct the most sensitive search to date for this particle. The experiment

was accepted by the Program Advisory Committee (PAC) of the Brookhaven National Laboratory Alternating Gradient Synchrotron (AGS) in 3/94. This is one of the first completely new experiments to be accepted by the AGS in some time.

I have overall responsibility for the experiment electronics, including the fast event trigger, and for the high-rate beam detector system. This system will include a detector which will determine, in real time, the centrality of a particular nuclear collision. This is, in effect, a measure of the degree to which the colliding nuclei struck one another head-on. This determination must be made in about 100 ns.

During the past quarter, I worked on the detector designs and participated in experiment planning activities. I have made preliminary arrangements for the actual fabrication of the beam and centrality detectors to be carried out at Johns Hopkins University.

I will also participate in the development of a second level (software or hardware) trigger and will have a part in development of the critical Distributed Drift Chamber (DDC).

During the past quarter, I participated in a technical review meeting for E896 at Brookhaven National Laboratory.

POEMS (POsitrone Electron Magnet Spectrometer) - This is an experiment to measure the cosmic ray electron and positron flux, using a magnetic spectrometer technique. POEMS was accepted for phase B development as a Small Explorer. The silicon strip detector hodoscopes are to be built by GSFC. During the past quarter, I participated in a number of POEMS collaboration activities.

New Satellite Experiments: During the past quarter I worked on the conceptual development of two new experiments to be proposed in response to the USRA satellite AO. These experiments will be closely tied to university collaborations involving University of California, Berkeley, The University of Minnesota, Louisiana State University and Louisiana Institute of Technology..

In addition, I worked on the development of three possible satellite experiments to be performed by international collaborations.

Quarterly Report for Brenda L. Dingus  
Activity: 5030-12A-39

Proposal Accepted:

ROSAT AO-5      "X-Ray Observations of Unidentified EGRET Gamma-Ray  
Sources Located Off the Galactic Plane"  
CoI: Greg Madejski (USRA/GSFC) & Matt Malkan (UCLA)

Presentations Made:

Snowmass, CO      Plenary Talk "MeV to GeV Gamma-Ray Astronomy Highlights"  
Snowmass, CO      "EGRET Observations Relevant to TeV Astronomy"

Papers in Progress:

"EGRET Observations of Galactic Latitudes  $-30 < b < -10$ "  
"Delayed, High Energy Emission from Gamma-Ray Bursts"

Paper Submitted:

"Extended, High Energy Emission from a Gamma-Ray Burst", K. Hurley,  
et al. to Nature

Lab Work:

Transferred drift chamber stack to balloon gondola.  
Assembling a vacuum pumping system for balloon gondola.

University Collaborations:

MILAGRO      MILAGRO is a ground based TeV gamma-ray detector  
that is a collaborative effort of University of  
Maryland, UC Irvine, UC Santa Cruz, and Los Alamos  
National Laboratory. Spent 10 days in Los Alamos.

*Brenda L. Dingus*

*7/15/94*

07/08/94

P.Sreekumar  
Activity: 5030-12A-39

The routine reduction of data from the EGRET instrument on the Compton Gamma Ray Observatory continues and during the last quarter, I have been primarily assisting the team to carry out the analysis. In addition, my routine responsibilities include helping out with overseeing the manual editing of spark chamber events on screens, creating the summary database and the exposure history database for each viewing period. A quick look skymap of the region is made along with the exposure and intensity maps to examine the presence of any new, interesting or unexpected source of high energy radiation. This is necessary to inform Guest investigators and multiwavelength community.

Additional analysis on the high energy gamma ray emission from the North Galactic Pole region continued during this quarter. The results will be submitted as one of a series of papers by the EGRET team in the Astrophysical Journal next month. Simultaneously, work on the high latitude diffuse emission is in progress. A new version of the EGRET allsky DIFFUSE model was released recently. This incorporates many improvements made in the Galactic plane model (Dr. S. Hunter) as well as at high latitudes. Full sky residue plots are created to examine the presence of an isotropic diffuse component of extragalactic origin. I am also working with Dr. R. Poola, visiting senior NRC fellow on examining the stability of the three bright gamma ray pulsars (Crab, Geminga and Vela) and in particular, on the presence of unpulsed components. On June 19th, Dr. David Seckel from the Bartol research center, Univ of Delaware was visiting. We worked on the question of steady gamma ray emission from the quiet Sun. This is a follow-up on a earlier proposal we had jointly written with Drs. D. Bertsch, J. Mattox and T. Stanev (which was however not funded). Additional work on this subject will continue.

I also attended the APS meeting in Washington DC (April 8-12) 1994. During June 6-10, I attended the EGRET team meeting in Munich (Max-Planck Inst. for Extraterrestrial Physik). Since the focus of the meeting was diffuse emission modeling and analysis, I (along with D. Bertsch and S. Hunter) summarized the progress of the model as well as the analysis approach. Additional work on examining the instrumental background dependence on orbital phase, etc. are continuing. I am also involved in reexamining the normalization factors used to correct EGRET sensitivity as the spark chamber gas quality deteriorates with time.

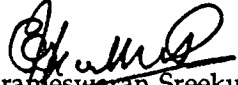
Meetings attended:

APS meeting, April, 1994, Washington DC:

EGRET Team meeting at MPE, Munich

Future Work:

1. Complete the North Galactic Pole analysis and the paper..
2. Continue working on the extragalactic diffuse radiation
3. Work on the Vela unpulsed component with Dr. Okkie De Jaeger (S. Africa) using EGRET phase 1+2 data.

  
Parameswaran Sreekumar

### **Quarterly Technical Report for 1 April 1994 to 30 June 1994**

James A. Miller, Code 665, (301)286-3642

In the above period, I was involved in four projects concerning particle acceleration in astrophysical sites, three of which were begun during the pervious quarter. First, I considered stochastic gyroresonant ion acceleration by cascading Alfven wave turbulence. Most of the applications of this work are to solar flare particle acceleration, but it also has implications for acceleration in black hole accretion disks. The basic model is that Alfven waves are generated at long wavelengths through, for example, a shear flow instability. These waves cannot resonant with background ions due to their small wavenumbers, but will cascade nonlinearly through wavenumber space to larger wavenumbers. When the wavenumber of the cascading waves becomes large enough, they will at that point be able to cyclotron resonate with the background ions, accelerating them out of the Maxwellian distribution to large (relativistic) energies. This process is described by two coupled, nonlinear, partial differential equations, with the coupling being provided by the damping of the waves by the ions. I have constructed a quasilinear code to solve this system, and have obtained results which are now in the process of being written up for publication in the Astrophysical Journal.

The second project is the investigation of the nonlinear Landau damping of two parallel Alfven waves by a hybrid plasma simulation. The analytical work on this mechanism is already complete, and we wish to compare those results with the simulation. This work is being done in collaboration with Adolfo Vinas in Code 692. We find large discrepancies with the analytical theory, probably due to particle trapping. We also find that bump-on-tail proton distributions result after the linear growth stage of the instability. These distributions in turn excite other plasma modes which may be useful in particle acceleration.

In the third project, with Chuck Dermer at NRL, we are looking into the problem of stochastic acceleration in black hole magnetospheres, along with the accompanying radiation processes.

The last project is on electron acceleration by fast mode waves, which is proving to be a very efficient means of energizing a large fraction of the ambient electrons to energies of more than 100~keV.

During the next quarter, I will be mostly involved with submitting three proposals to the NASA SR&T program, which has the deadline of 23~August.

□

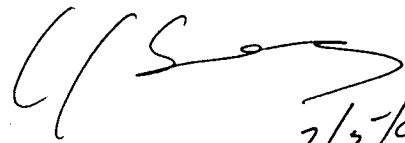
To: Ms. Crystal C. Wheatley, USRA  
From: Yang Soong, LHEA Code 666, Bldg. 2, Rm 271, X66318  
Date: June 30, 1994  
Subject: Technical Report for 4/1-6/30, 1994

We are carrying out research which was part of the center DDF proposal. The improvements of the image of the thin foil X-ray mirror with the newly established replication process has been verified. A step forward in implementing the technique to the next generation X-ray telescope is well underway. A summer student, Andrew Gray, was selected through the DDF to participate in the activities in this research and development program. Another proposal for lab development in the next three years to the NASA/HQ was also funded with the level at \$75k for mirror research. We also will be thinking and planning for mirror development beyond year 2000 when a cluster of X-ray astrophysics missions would be carried out at the end of this century.

The Astro-E, a US-Japan collaboration which will be a successor of the current ASCA satellite, is in negotiation. We, the Goddard group, will be providing X-ray mirrors, a state-of-the-art high spectral resolution focal point detector, and the data acquisition and analysis system, if we come to an agreement. The need for manpower is urgent. There was a hiring announcement in the April 9th AAS job register posted by USRA, and an internal review of the applications was conducted, by which a committee was chaired by Dr. Will Zhang of USRA. Four applicants were selected to be on the short list, and subsequent interviews are being scheduled. Dr. Atish Sen from JPL was the first interviewed on 6/27, and the final decision will be made in the next quarter.

ASCA data analysis is underway. We are sharing the PV phase data among the PI groups. I am working on the Galactic binary X-ray emitters, such as Her X-1, Vela X-1, 4U0614+091, etc. The spectral data is superior to that of the previous missions due to the excellent energy resolution of the CCD detector. The spatial resolution matched our expectation with the ground testing results. Papers have been presented in various meetings and published or to be published in professional journals.

These activities have been supported by the task # 5030-14A-39.

  
7/5/94

QUARTERLY REPORT TO USRA FOR THE PERIOD  
1st April 1994 – 30th June 1994

Tahir Yaqoob

TASK No. 93-15-00; EMPLOYEE ID: 05-05 96800

Following is an outline of accomplishments this period. I will deal with each project in turn.

**Papers Published**

The following papers, were published in the *Publications of the Astronomical Society of Japan (ASCA special issue)*:

- (i) The Complex X-ray Spectra of two High Redshift Quasars Observed with ASCA (Serlemitsos *et al.*).
- (ii) The X-ray Emission of 3C 273 Observed with ASCA (Yaqoob *et al.*).
- (iii) ASCA observation of the warm absorber in MCG-6-30-15: Discovery of a Change in the Column Density (Fabian *et al.*).
- (iv) An ASCA observation of One Orbital Cycle of AR Lac (White *et al.*).
- (v) The Discovery of an Obscured Low Luminosity AGN in the Spiral Galaxy NGC 4258 (Makishima *et al.*).

**Papers Submitted**

- (i) X-ray Spectrum and Variability of the Quasar PG1211+143 (Yaqoob *et al.*).
- (ii) Rapid X-ray Spectral Variability in NGC 3227 (Ptak *et al.*).
- (iii) An ASCA Observation of the Seyfert 2 Galaxy MKN 3 (Iwasawa *et al.*).
- (iv) New X-ray Spectral Observations of NGC 4151 with ASCA (Weaver *et al.*).

**Other Articles**

The talk I gave at the March symposium, 'New Horizon of X-ray Astronomy', was written up for publication in the proceedings. The article was entitled 'ASCA Observations of Quasars in the PV Phase'. The article describes the main new results from observations of all the quasars by ASCA in the PV phase which lasted about 8 months.

## Analysis of ASCA Data

In this period, analysis of *ASCA* data concentrated mainly on the four targets PG1211+143, NGC 3227, MKN 3 and NGC 4151. The final results for all four objects were written up in this period and the corresponding papers submitted to journals. The main scientific results in these papers have been outlined in previous reports.

## ASCA and ROSAT Proposals Accepted

Observing time was won with *ASCA* in the AO-2 phase for the for the following proposals.

1. Testing the Accretion Disk Hypothesis in NGC 7314 (PI Yaqoob).
2. An *ASCA* Investigation of the High Equivalent Width Iron Line in MKN 290 (PI T. J. Turner).
3. Spectral Study of the Bright High Redshift Quasar PKS 2149-306 (PI H. Kunieda).

Also successful was a *ROSAT* HRI proposal entitled 'Do Spiral Galaxies Harbor Low Luminosity AGN?' (PI Serlemitsos *et al.*).

## IDL Analysis Tools

As well as updating and adding new routines to the suite of IDL routines especially developed for *ASCA* analysis over the past year, the status of documentation on the analysis tools was significantly advanced in this period.

## WORK PLANNED FOR NEXT QUARTER

In the next quarter, analysis of further *ASCA* PV data, as well as new data obtained in *ASCA* AO-1 will begin. Also, proposals will be written for the *ASCA* AO-3 phase and the IDL analysis tools and their documentation further advanced.

June 25, 1994

**Quarterly technical report for Grzegorz (Greg) Madejski,  
working under USRA contract no. NAS5-30442 to  
NASA/Goddard Space Flight Center for the quarter  
ending June 30, 1994**

My activities continue to include programmatic work (the X-ray Spectrometer) as well as independent research (X-ray emission from AGN and BL Lacs).

**1. The X-ray Spectrometer.**

The primary responsibility at the lab continues to be the work related to the development of the X-ray Spectrometer (XRS) instrument.

As I wrote in my report of 3/31, the X-ray Spectrometer project has recently undergone a significant change in scope. Despite the cancellation of AXAF-S, the congressional budget mandated that the development of the instrument should continue, with the intent to fly it on a Japanese mission ASTRO-E.

Astro-E will be the next in a series of X-ray sensitive satellites, which included the highly successful Astro-C, or Ginga, and Astro-D, or Asca. As other Astro missions, Astro-E is devoted to study of X-rays from celestial objects, and is administered by the Japanese Ministry of Education. The Japanese organization responsible for the implementation of the satellites is Institute for Space and Astronautical Science, or ISAS (in Sagamihara). ISAS often collaborates with other nations in the development of the payloads for their satellites, and, in fact, Asca featured mirrors developed by Dr. Peter Serlemitsos at the Goddard's Lab for High Energy Astrophysics, and built at Goddard.

ISAS developed the concept for Astro-E in 1993, before the incorporation of the XRS into it, and as a result, the total payload dimensions and weights were approximately known for some time. In order to make the XRS compatible with the Japanese spacecraft, many changes had to be made to the instrument design; most notably, the weight, physical dimension and power consumption had to be reduced to fit the desired constraints. Nonetheless, the basic concept of the XRS remains unchanged: it will be a sensitive X-ray spectrometer, devoted to high resolution spectroscopy of celestial X-ray sources, placed behind a high-throughput X-ray mirror. The XRS would be one of several instruments on Astro-E. One of the main activities of the entire XRS team at Goddard during the last quarter was the "resizing" of the instrument to fit the constraints of ASTRO-E. Furthermore, NASA and ISAS agreed that the mirror, used to focus the X-rays on the XRS detector, would be built and developed at Goddard as well.

The XRS detectors will be basically the same as planned for AXAF-S. The main change to the instrument would be a different, lighter cryogenic subsystem. (The cryogenic subsystem is necessary to maintain the detectors at their operating temperature of 0.1 K.) The redesigned cryogenic subsystem now includes a two-stage dewar, with the outer dewar using solid cryogen (most likely solid neon), and inner dewar, using superfluid helium. That is in contrast to the original AXAF-S design, where a single-stage dewar was to be used, with superfluid helium. Despite the substantially lower instrument weight and volume, the predicted cryogen lifetime was kept to 3 years, only slightly less than that for AXAF-S. We recently had a meeting at Goddard with our Japanese colleagues to discuss the overall interface between the satellite and the instrument. Specifically, my responsibility continues to be in the area of blocking filters, calibration, and background.

## 2. Astrophysical Research.

A number of papers has been resubmitted or is in press. New projects were initiated.

### • Projects/papers completed or substantially advanced in the 2nd quarter of 1994:

- Analysis of the data for the multiwavelength campaign for BL Lac object PKS2155-304 has been completed. The second paper, reporting the ROSAT data, is now in press in *Astronomy and Astrophysics* (Brinkman *et al.*); preprint is enclosed. The third paper, cross-correlation between the optical, UV, and X-ray data for PKS 2155-304 during the campaign, is also in press in *Ap. J.* (Edelson *et al.*); preprint is enclosed.

- Analysis of the X-ray spectral data for BL Lac object AO 0235+164 (Strong X-ray absorption as compared against the radio 21 cm data indicates abundances of heavy elements twice of our own Galaxy) is in press (*Ap. J.*, Sep. 10, 1994), and the Goddard preprint is enclosed.

- Analysis of the simultaneous X-ray and gamma-ray spectral data for Seyfert 1 galaxy IC4329A (Madejski *et al.*) is now in press in the *Ap. J.*; preprint is enclosed.

- The companion paper, describing the theoretical implications of the above observational data (by Zdziarski *et al.*) is complete, and has been resubmitted to the *Monthly Notices of the Royal Astronomical Society*; preprint is enclosed

- Study of reprocessing in Seyfert I galaxy NGC 6814 (with Drs. Czerny, Loska, and Cukierska of Copernicus Center, Warsaw, Poland) has been received back from the *Ap. J. Letters*, and has been resubmitted to the *Ap. J. (Letters)* with requested changes.

- Paper describing the analysis of the BBXRT data for BL Lac object PKS2155-304 is now accepted (Madejski *et al.*), and undergoing revisions.
- Data for multi-wavelength campaign to observe OVV blazar 3C279 (with Drs. Urry, Maraschi, and Wehrle) is in the final stage of analysis; the first paper (Overall spectral variability by Maraschi *et al.*) is now submitted to *Ap.J. Letters*.
- Joint IUE/EUVE observations of AGN (Greg Madejski's IUE grant, with Drs. Carone, Marshall, Porter, and Urry) is now being written up for publication (Carone *et al.*).
- Identification of the periodic source RXJ1940 in the field of NGC 6814 (with Drs. Watson, Done, Rosen, and Osborne of Leicester University) is being written for publication in the *Monthly Notices of R.A.S.*
- With Dr. Abramowicz of Goteborg University, we were invited to write a retrospective paper about the research on periodicity in NGC 6814 for Swedish popular science magazine *Forskning och Framsteg*. We submitted the draft early in June.
- **New projects being initiated :**
  - Pattern stability in the time series of Cataclysmic Variable RXJ1940 (with Dr. Abramowicz at Goteborg University and Dr. Bao at Trondheim University);
  - Spectral constraints on models of BL Lac objects and OVV quasars (with Drs. Sikora and Begelman at the University of Colorado);
  - Observational constraints on vertical structure of accretion disks in AGN (with Prof. Begelman, Dr. Sikora, and Dr. Stern at the University of Colorado);
  - Research on continuum emission of OVV quasars, and specifically joint Asca - GRO Egret observations (a collaborative effort with the University of Tokyo colleagues).
- **Other :** the discovery of the real source of periodicity in the field of Seyfert galaxy NGC 6814 was noted in *Sky and Telescope* (copy of the article enclosed).
- **Recently accepted proposals (as a PI):**
  - ASCA : Soft X-ray spectrum of Seyfert galaxy ESO 141-G55.
- **Submitted proposals (pending, as a PI):**
  - 2 for ROSAT observing time, and 2 for GRO observing time.

## Technical Report through Jun 94

Name : Rachel Gibbons

Code : 666

Task Number : 600-026

I continue to be an assistant to Dr. Richard Mushotzky (LHEA). I assist him in accomplishing various tasks. These assignments include editing journal/review articles, preparing proposals on a less scientific front.

I am continuing research on the origin of the X-ray background and collaborate mostly with Richard and David Davis, a Ph.D. student under Richard. I am in the process of finishing error calculations for our model and finishing the draft of a paper discussing our results, which we plan to publish.

Recently, I have assisted David Davis with related research on clusters of galaxies which he will use in some of the data analysis for his thesis (which will hopefully be finished in August 94!).

## Technical report for Michael Loewenstein, 4/1/94-6/31/94

My primary activity over the past quarter involved ASCA PV phase observations of the elliptical galaxies NGC 1404, NGC 4374, and NGC 4636. We (Richard Mushotzky of the X-ray Branch is my primary collaborator; there are several Japanese co-authors as well), have discovered anomalously low heavy metal abundances in NGC 1404 and NGC 4374 as well as (for the first time) an abundance gradient in NGC 4636. These results have profound implications for the formation of elliptical galaxies and the enrichment of intracluster media. We have also used the temperature profile of NGC 4636 to infer the presence of a dark matter halo that is 15 times as massive as the luminous matter. This work has been submitted to the Astrophysical Journal Letters for their special ASCA edition, with myself as lead author on the NGC 1404 and NGC 4374 paper and second author on the NGC 4636 paper.

I am concluding my ROSAT PSPC investigation of the elliptical galaxy NGC 4697 that includes spatial and spectral analysis of both diffuse emission and a remarkable population of point sources. This galaxy could provide a key to understanding the X-ray emission mechanisms of low-luminosity early-type galaxies.

Unfortunately, the two ASCA AO-2 proposals that I was PI of were rejected; however, two targets on a proposal that I was Co-I on have been approved.

In the next quarter, my priorities are (1) finishing up the NGC 4697 analysis and writing it up for publication, (2) preparation and preliminary analysis of ASCA data on NGC 4697 (from a successful AO-1 proposal) which is due to be observed July 2, and (3) writing and submitting ASCA AO-3 proposals.

## Report of activity for the period April - June 1994 - Ivan HUBENY

During this period, I have continued working on an analysis of the Hubble Space Telescope observations using my computer program TLUSTY for computing non-LTE line blanketed model stellar atmospheres. The work is done mostly in collaboration with Drs. Sally Heap, T. Lanz, and A. de Koter.

In April, we have obtained the first post-servicing mission GHRs spectra of two hot stars, members of the R136 cluster of 30 Doradus in the Large Magellanic Cloud, and performed their preliminary analysis. The results are presented in two papers submitted to the *Astrophysical Journal Letters*.

During my trip to Zurich, Switzerland, I have collaborated with Dr. Werner Schmutz on modeling winds of early-type stars, in particular on a detailed analysis of HST spectra of several Of/WN stars.

I gave an invited talk on "Physics of Massive Hot Stars" at the Special Session, entitled Massive Hot Stars with the Hubble Space Telescope, at the 184th AAS meeting in Minneapolis, I have also prepared several poster papers for this meeting in collaboration with various researchers.

I have concluded a series of lectures entitled "GHRs Short Course on Stellar Atmospheres" for all interested employees of Goddard (Codes 680 and 660). Judging from the reaction of attendees, the course was rather successful.

### *Trips accomplished:*

- i) April 15 - 30, ETH Zurich, Switzerland. Collaboration with Dr. Werner Schmutz on modeling winds of early-type stars and analysing HST spectra of several Of/WN stars.
- ii) May 28 - June 2, Minneapolis, MN, 184th meeting of AAS.

### *Papers published:*

Hubeny, I., Hummer, D.G., Lanz, T., 1993, "NLTE Model Stellar Atmospheres with Line Blanketing Near the Series Limits", *Astron. Astrophys.* 282, 151

Holberg, J.B., Hubeny, I., Barstow, M.A., Lanz, T., Sion, E.M., Tweedy, R.W., 1994, "The Discovery of Ni V in the photospheres of the hot DA white dwarfs RE 2214-492 and G191 B2B", *Astrophys. J. Letters* 425, L105.

Long, K.S., Wade, R.A., Blair, W.P., Davidsen, A.F., Hubeny, I., 1993 "Observations of the bright novalike variable IX Vel with the Hopkins Ultraviolet Telescope", *Astrophys. J.* 426, 704.

Horne, K., Marsh, T.R., Cheng, F.H., Hubeny, I., Lanz, T., 1993, "HST Eclipse Mapping of Dwarf Nova OY Car in Quiescence: An 'Fe II Curtain' with  $\text{Mach} \simeq 6$  Velocity Dispersion Veils the White Dwarf", *Astrophys. J.* 426, 294.

### *Papers submitted:*

Sion, E.M., Cheng, F.H., Long, K.S., Szkody, P., Gilliland, R.L., Huang, M., Hubeny, I., "Hubble Space Telescope *FOS* spectroscopy of the ultra-short period dwarf nova WZ Sagittae: The underlying degenerate", *Astrophys. J. Letters*, submitted.

Heap, S.R., Ebbets, D., Malumuth, E.M., Maran, S.P., de Koter, A., Hubeny, I., "GHRS Spectroscopy of Individual Stars in R136a", *Astrophys. J. Letters*, submitted.

de Koter, A., Hubeny, I., Heap, S.R., Lanz, T., "Theoretical modeling of GHRS observations of the Of/WN-type star R136a5", *Astrophys. J. Letters*, submitted.

Linnell, A.P., Hubeny, I., 1994, "A Spectrum Synthesis Program for Binary Stars", B.A.A.S. 26, 868

Hubeny, I., 1994, "Physics of Massive Hot Stars", B.A.A.S. 26, 913.

Lanz, T., Hubeny, I., 1994, "NLTE Model Stellar Atmospheres: The Hybrid CL/ALI Method", B.A.A.S. 26, 924.

Wade, R.A., Cheng, F.H., Hubeny, I., 1994, "The Iron Curtain Effect in the Ultraviolet Spectra of Dwarf Novae Z Cha and OY Car", B.A.A.S. 26, 936.

*My plans for the next three months include:*

i) I will continue my work in theoretical analysis of hot stars, in collaboration with Drs. Sally Heap, T. Lanz, and A. de Koter. In particular, we will continue our analysis of the individual stars in the R136a cluster in 30 Doradus.

ii) I was asked to give an invited talks on "Hydrogen Line Profiles" in the 22nd General Assembly of IAU in Den Haag, Netherlands; and on "NLTE model atmospheres for metal rich white dwarfs" in the workshop on White Dwarfs in Kiel, Germany.

iii) I will continue in a collaboration with Dr. B. Lites (HAO, Boulder) on radiative transfer with partial redistribution; we plan to finish and submit a paper during my short stay in Boulder in July.

iv) I will continue in preparing the textbook "Stellar Atmospheres", 3rd edition, in a collaboration with Dr. D. Mihalas.

v) I was asked to write a chapter on "Feautrier method and accelerated lamda iteration" for the book "Computational Astrophysics"; I intend to continue working on it during this period.

*Travel plans:*

i) July 14 - 25, Boulder, CO. Collaboration with Dr. B. Lites on radiative transfer with partial frequency redistribution; and with Dr. D. Mihalas on textbook "Stellar Atmospheres".

ii) Trip to Europe in three parts:

a) August 3 - 9, Prague and Ondrejov, Czech Republic. Giving several colloquia, and collaboration with Dr. P. Harmanec on accretion disk model for the  $\beta$  Lyrae systems.

b) August 17 - 28, Den Hague, Netherlands. Attending the 22nd General Assembly of the International Astronomical Union, and presenting an invited paper on "Hydrogen Line Profiles" on the Joint Discussion 12.

c) August 29 - September 2, Kiel, Germany. Attending workshop on White Dwarfs; presenting an invited talk on "NLTE model atmospheres for metal rich white dwarfs".

## TECHNICAL REPORT - 2nd QUARTER 1994 (1 April - 30 June 1994)

Activity: 5030-20A-39

### I. SUMMARY

#### A. Task Work

##### 1. SAS-2 FITS files and FADMAP program.

The analysis program FADMAP was completed during the 1st Qtr 1994 and was tested during the 2nd Qtr 1994. The SAS-2 and COS-B data were then processed and the results found acceptable. The output FITS files then had to be approved by the OGIP FITS committee and any corrections made. This process took until the end of June when at that time the, hopefully, final version of this program was used to create the SAS-2 and COS-B processed FITS files. These files will then be made available to the public on the HEASARC's 'legacy' computer archive.

The transferring of the SAS-2 data from 9-track magnetic tape to 8mm DAT tape is halfway complete. It is hoped that this project will be completed soon.

When the all the data is finally processed and OK by those responsible, final work will begin on documenting the data and the associated reduction program. The possibility of making some paper documents accessible in electronic form has also been considered. These will most likely continue into the 4 Qtr 1994, due to other programmatic work.

##### 2. GROSSC Tasks

###### a. Observation Database on GRONEWS

Work was done on developing a simple query program to access and display the observation file containing the list of archival GRO data. This program was completed at the end of the 2nd Qtr. As a result of this work an error was found in one of the archive databases.

###### b. Publication Database on GRONEWS

Work continued on developing a list of publications about the Compton Gamma-Ray Observatory and related gamma-ray issues. Version 1 of this program was completed during the 2nd Qtr 1994. Initial results of this work were used in a presentation to NASA HQ to show the success of the GRO mission.

This database will be publicly accessible using the GRONEWS account at the GROSSC. Continued work involves keeping the publication list as current and complete as possible.

c. Article for book on "Databases & On-Line Data in Astronomy"

An article was written for a book entitled "Databases & On-Line Data in Astronomy". The article will give a summary of the Compton Gamma-Ray Observatory mission, the contents of the GROSSC archive and the support for data analysis at the GROSSC.

d. Gamma-Ray Burst Publication List

A list of gamma-ray burst publications compiled by Dr. Hurley was processed and installed on GRONEWS.

e. Gamma-Ray Burst Models

A list of all distinct gamma-ray burst models compiled by Dr. Nemiroff was processed and installed on GRONEWS.

f. Workstation System Administration

Several days during April and May were spent building and installing application software for my workstation.

g. Attended the GRO User's Committee Meeting at the end of June.

## B. Research

### 1. ASCA NRA 2 Proposals

Submitted 4 proposals for ASCA NRA, Cycle 2, with the following titles: "ASCA Spectral Studies of the Unusual Intermediate Polar TV Col", "ASCA Spectral Studies of AE Aqr", "ASCA Observations of HEAO-1 Discovered Intermediate Polars", and "ASCA Observations of ROSAT Discovered Intermediate Polars". Sadly none of these proposals were accepted. Yet two proposal where I was a co-I and Eric Schlegel was PI were accepted.

## 2. ROSAT NRA 5 Proposals

Submitted 4 proposals for the ROSAT NRA, Cycle 5, with myself as PI and having the following titles: "Observations of Probable Intermediate Polars", "Precessing the Disk in TV Col", "Observations of AE Aquarii: A Low-Powered Analog of Cyg X-3", and "The Period-Gappers: RE J0531-461 and RE J1938-462". None of these were accepted. Along with D. Buckley as PI and myself as Co-I, 2 other proposals were submitted having the titles: "X-Ray Light Curves of RX J0929-2404: The Longest Period Eclipsing Polar", "Missing Links in Magnetic CVs: The Intermediate Systems RX0515+011 and 1H1752+081", and "Temporal Study of the Multi-Periodic Intermediate Polar TX Col". Both of these proposals were accepted.

## 3. TV Col Data Analysis

Some analysis work of this Cataclysmic Variable was done during the first half of 1 Qtr. Preliminary results were presented in the ROSAT proposal of the same object and at the Padova-Abano Cataclysmic Variable Conference in June.

## 4. Compton/EGRET Data Analysis of Cataclysmic Variables

Results from this work have been submitted to the ApJ with Eric Schlegel as first author. A second paper with myself as first author is still in preparation.

## 5. Compton/COMPTEL & OSSE Data.

Little progress has been made on the COMPTEL and OSSE data due to other more pressing work.

## 6. Poster Paper presented at Cataclysmic Variable Conference

I attended the Padova-Abano Conference on Cataclysmic Variables in Italy during mid-June and presented two papers. The first presented preliminary results of a ROSAT analysis of TV Col data and the second presented results from the Compton/EGRET Survey of Cataclysmic Variables.

# II. FUTURE WORK AND RESEARCH

## A. Task Work

### 1. COS-B and SAS-2 Documentation.

Documentation for the COS-B and SAS-2 data will be completed. The documentation includes: a discussion of the COS-B and SAS-2 data restoration and a User's Guide to the FADMAP program.

## 2. Compton GRO Publication Database

Continue enhancing the GRO publication database by adding new publications.

## 3. Compton Observatory NRA 4.

Will continue to assist with the proposal review for the Compton Observatory.

# B. Research

## 1. Infra-red Space Observatory Proposal (ISO)

Preparation of a proposal to do photopolarimetry of asynchronously rotating magnetic cataclysmic variables will be done. The aim of this proposal is to detect, for the first time, polarization from these CVs to determine their magnetic field and hence to understand their secular evolution. This proposal will be an international collaboration.

## 2. ASCA AO-3 Proposals

Preparation of proposals for ASCA AO-3 will be done. The proposal from AO-2 will be modified and resubmitted.

## 3. Cataclysmic Variable Research

Work on two papers about gamma-rays from Cataclysmic Variables will continue during the 3rd quarter of 1994 as well as analyzing the other data obtained from my overseas observing trip. It is hoped that these papers will be submitted during this time period.

## 4. Analysis of ROSAT Data of TV Columbae

It is anticipated that some time will be spent further analyzing ROSAT data of TV Col in preparation for its presentation at a meeting about Cataclysmic Variables in Italy in late June.

# III. MEETINGS AND SYMPOSIA ATTENDED

Padova-Abano Conference on Cataclysmic Variables Abano Terme, Italy; 1994 June 20-25.  
Presented two poster papers.

□

## Quarterly Report

*activity 5030-20A-39 : grossc at gsfc  
period april 94 through june 94*

### Performed ...

- assisted in preparation of materials for nasa hq white paper presentation for cgro project.
- supported cgro proposal review.
- assisted in the preparation of materials for a gro display at the national air and space museum.  
this work is on going.
- prepared version 1.2 of the Compton GRO Science Support Center users' guide.
- performed time domain and spectroscopic analysis of gamma-ray bursts and support duties for the search for optical burst counterparts in accordance with on going research projects.

### Planned ...

- continue work as directed on gro display at national air and space museum.
- assist in preparation of visual material and text for an educational slide set for cgro.
- produce updated version of users' guide.
- continue research activities.

□

Jul 15 '94 at 1:59 pm

Quarterly report for Dr. Mark H. Finger  
April 1 - June 30 1994:

During this quarter production of Archival data has made good progress. The software for generating corrected pulsar low level folded on board data in FITS format was completed, tested and production begun. During the quarter four exabyte tapes of data were delivered. These contained IBDB's (burst trigger mode data) for 196 burst, 129 solar flares, and one SGR, CONT and DISCLA FITS files for TJD 8587 to 8761, Her\_cor and Sher\_cor data for TJD 8686-8925, pulsar low level data FITS files for TJD 8392-8564, and a log of folded-on-board pulsar observations complete to TJD 9120. No data has been delivered since June 8th because a problem was discovered in some FITS primary headers involving the day of year. This problem should be corrected soon.

Guest Investigator visits to MSFC during the quarter included Michiel van der Klis, Jim Ling and Richard Schwartz. Michiel Berger, a graduate student of van der Klis remained for three weeks to epoch fold Vela X-1 over the entire mission. I interacted with him extensively during this time.

In June I attend the Compton Observatory peer review to provide the panels with technical expertise on the BATSE instrument.

I am involve in three cycle 4 Compton Observatory guest investigation proposals that were submitted in april. The first, of which I am P.I., is for the study of aperiodic flux variability in the x-ray binary A0535+262. The second, with Michiel van der Klis as P.I., is to continue pulse timing studies of Vela X-1 and Cen X-3. The third, with Chryssa Kouveliotou as P.I., is to continue power spectral studies of black hole candidates.

My research during this quarter has focused on two areas; the aperiodic flux variability seen in the recent outburst of A0535+262, and a new technique I am developing for the estimation of pulsar accretion torque power spectra from pulse phases. The qpo-like feature seen in the power spectra of A0535+262 during the February-March outburst show are centered on a frequency that is tightly correlated with the torque inferred from the pulse timing. By assuming that the qpo is centered on the beat frequency between the rotation rate of the inner edge of the accretion disk and the rotation rate of the neutron star, the qpo frequency can be used to determine the mass accretion rate, and therefore the torque predicted by various models. This observations are therefore provide a test of the models. The power spectral technique I am working on involves the use of sequential estimation techniques for modeling stochastic processes. The technique is fairly general, works in the presence of non-uniform sampling and extremely red noise, but is computationally expensive.

## Plans for the 3rd Quarter.

During the 3rd quarter I plan hope to have the delivery of IBDB's, DISCLA and CONT FITS files, Her\_cor and Sher\_cor files, and pulsar low level FITS files on a schedule of one year after data collection. The remaining production problems will then be with the higher level pulsar and occultation products. A production of epoch folded pulse profile files is underway. The occultation team is not yet ready to release source histories for archiving, but has been providing them to guest investigators at there request.

In late July and early August I am going to Amsterdam to work with Michiel van der Klis on Vela X-1 and Cen X-3 analyses. The problems we are addressing are orbital determination, detection of any changes in the orbital parameters, and the power spectra of the sources torque. We hope to have journal papers submitted on these studies by the end of the year.

I am currently writing a paper on the A0535+262 outburst that will by presented by my co-author Bill Paciesas at IAU symposium #165 in August.

I will be writing a paper on Coded Aperture Imaging with Tom Prince at Caltech for the Capri workshop on Imaging in September.

□

John Mattox

Jul 14 '94 at 1:54 pm

## QUARTERLY TECHNICAL REPORT

During the period April 94 through June 94, I wrote ~130 E-mail message in support of EGRET guest investigator activities, and made or received ~30 phone calls.

My paper on the likelihood analysis of EGRET data has been submitted to Ap J. All three of my cycle 4 EGRET proposals have been accepted.

John Mattox

□

Tom McGlynn                      Jul 21 '94 at 1:50 pm  
<MCGLYNN@grovx1.gsfc.nasa.gov>

## Activities 2Q94 for T. McGlynn

McGlynn provided technical leadership and coordination for the COSSC software group. Activities included the development of software to generate standardized EGRET formats, new Mosaic interfaces to COSSC data holdings and software, and the development of conversion utilities for OSSE and COMPTEL files to generate archive data in FITS formats.

McGlynn generated the first Compton CD ROM which contained information from the EGRET Phase I all sky survey. This CD was produced on short notice and included new data formats reviewed by the OGIP FITS committee.

McGlynn continued the development of the SkyView system. Several new releases were made to include EGRET and ROSAT data, to provide major new functionality such as image overlays and data smoothing, and to fix bugs that had been found. Work to incorporate the SSS optical survey into SkyView began in earnest with the delivery of the 60 CD set of images.

McGlynn presented a paper at the Minneapolis AAA on SkyView entitled SkyView: The Digital Sky on the Internet with co-authors, N.E. White and K.A. Scollick. McGlynn presented a slightly different version of this paper for the user interface workshop held at Goddard in June.

McGlynn and Scollick (CSC) developed an exhibit for SkyView which was presented at the Minneapolis AAS. Presentations of SkyView software were offered and many astronomers were interested in SkyView services.

McGlynn organized the GRO exhibit at the Minneapolis AAS. Demonstrations of GRO software were given and approximately 240 copies of the the EGRET CD were distributed.

McGlynn managed the Compton Fellowship program, working with new and existing fellows to iron out any problems in their grants.

McGlynn continued to work on the analysis of EGRET observations of clusters of galaxies.

□

Quarterly Progress Report for  
Chris R. Shrader, USRA/CGRO -SSC  
(Activities for April 1 - July 1, 1994)

**CGRO Guest Investigator Program:** A large amount of effort was made during the reporting period in preparation for the Cycle-4 CGRO Guest Investigator Proposal review, which occurred on June 27-29. This was a MAJOR effort and it occupied the bulk of my time during this quarter. My responsibilities included over seeing the effort to log in the proposals and ingest relevant information into a database. The 236 proposals were then topically sorted, and divided into five subsets for panel review. Arrangements were made with a total of 46 scientists to serve as anonymous peer-review panelists, and effort which involved making over 100 telephone calls. Proposals were assigned for review matching, to the extent possible in consideration of conflicts of interest and the diverse range of science supported by the CGRO program, the reviewer's expertise to proposal topics. Real time support at the time of the review was provided, including the supervising of technical and support staff personnel.

Guest Investigator inquiries, too numerous to list, were handled. Subjects included instrumentation technical details, program policies and procedures and the planned proposal evaluation process.

**Project Support:** Efforts continued towards the development of a CGRO exhibit at the National Air and Space Museum (NASM). The exhibit plan was presented to NASM during April, and is currently undergoing review.

Extensive preparation was made for a presentation to NASA Headquarters requesting an extended (i.e. beyond 1996) of the CGRO mission. A "White Paper", summarizing scientific achievements of the mission to date and presenting a case for future potential was drafted and circulated among the CGRO Instrument Principle Investigators and Project Scientist for review. A presentation detailing the benefits of an extended CGRO mission was presented to NASA Headquarters officials on April 22.

A CGRO Users Committee was held on June 30 and July 1. At this meeting, various summaries of the results from the CGRO Cycle-4 proposal review as well as reports on various ongoing CGRO-SSC activities were presented.

**CGRO-SSC Group Leader Activities:** An effort to fill the recently vacated OSSE Instrument Specialist position was initiated in coordination with USRA management. A selection committee was formed, chaired by myself, which reviewed the applications for the position and developed a "short list" of candidates. Several interviews were conducted.

Several internal CGRO-SSC organizational meetings were held to coordinate the various ongoing activities.

Scientific Research: A paper reporting on archival analysis of X-Ray temporal and spectral data on the transient high-energy source GRO J1008-57 was accepted (by D.J. Macomb and C.R. Shrader) was accepted for publication in the Astrophysical Journal.

Extensive analysis on a large body of multiwavelength data for the Seyfert 1 galaxy Markarian 841 was performed. One paper was accepted for publication and another is under preparation. This effort involves a collaboration with several other USRA LHEA scientists (T.J Turner and I.M. George).

□

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